# Adaptive FIR

# Annual Report

October 1, 1982-September 30, 1983

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## Southwest Oregon Forestry Intensified Research

Medford, Oregon



College of Forestry
Oregon State University

# Organization Responsibilities: OSU Forestry Intensified Research Fiscal Year 1983

The Forestry Intensified Research Program (FIR) is a cooperative research and technology transfer program directed at solving reforestation problems in southwest Oregon. It is jointly administered by the School of Forestry at Oregon State University (OSU) and the Pacific Northwest Forest and Range Experiment Station (PNW) of the USDA Forest Service. An advisory council comprised of representatives from major public and industrial forest management organizations, county governments and private citizens in southwest Oregon provides overall guidance for the FIR Program.

The objective of FIR's Adaptive Phase, conducted by OSU faculty stationed in Medford, is "to provide factual information directed at intensifying environmentally sound forest management practices in southwest Oregon by conducting adaptive research and extension education programs" (FIR Annual Report 1979). An important function of Adaptive FIR is coordination of its activities with that of Fundamental FIR scientists from several OSU departments and the PNW. Scientists in both groups review problems of mutual interest, coordinate research to avoid duplication of effort, and ensure that research addresses the most pressing silvicultural problems in southwest Oregon. Foresters and other specialists from client groups identify new issues for research and extension projects.

## Advisory Council

(FIR Client Representatives)

Provides advice and guidance on program direction and budget. (Council members listed on inside of back cover)

## Dean, College of Forestry

(Carl H. Stoltenberg)

Convenes Advisory Council. Makes major decisions on OSU support.

## Director, PNW

(Robert L. Ethington)

Makes major decisions on PNW support.

## FIR Program Leader

(Jack Walstad)

Coordinates activities of all organizations involved and provides overall program leadership and administration.

## Adaptive Phase

Project Leader
(Steve Hobbs)

Coordinates and provides leadership for the Adaptive Phase.

## Fundamental Phase

OSU and PNW
Principal Investigators/Project Leaders

Lead individual research projects

## Adaptive Phase Principal Investigators

Forest Science
- Reforestation (Steve Hobbs)
  (Ole Helgerson)
- Silviculture (Steve Tesch)

Forest Engineering
- Harvesting (John Mann)
- Watershed (Dave McNabb)

Lead individual research and extension projects.

## Adaptive Phase Support Staff

Research Assistants
- Beverly Yelczyn
- Mike Crawford

Technician
- Vern Crawford

Secretary
- Elaine Morse

# Cooperators

Bureau of Land Management
- Medford District
- Roseburg District

U.S. Forest Service
- Rogue River National Forest
- Siskiyou National Forest
- Umpqua National Forest
- Pacific Northwest Forest and Range Experiment Station

Southwest Oregon Forest Industries
- Boise Cascade Corporation
- C & D Lumber Company
- Champion Timberlands
- Eugene F. Burrill Lumber Company
- Herbert Lumber Company
- KOGAP Manufacturing Company
- Longview Fibre
- Medford Resource Corporation
- Roseburg Lumber Company
- Rough & Ready Lumber Company
- Spalding and Son, Incorporated
- Sun Studs, Incorporated
- Superior Lumber Company, Incorporated
- Timber Products Company

Oregon State Department of Forestry

Oregon State University

Southwest Oregon Counties
- Curry
- Douglas
- Jackson

# Contents

# Summary
## Fiscal Year October 1, 1982-September 30, 1983

Adaptive FIR provides information that will help reforest southwest Oregon sites that have been very difficult to regenerate. Through both research and education, Adaptive FIR ensures that area foresters have the best information available to solve reforestation and management problems on the steep, harsh sites with rocky soils and/or hardwood brush cover that are common to large portions of the timberlands in southwest Oregon.

During its fifth year, Adaptive FIR has:

- completed one research project, continued research on ten others, and initiated three
- held six workshops for 453 participants
- presented research results and other information in 11 articles and reports
- provided information and consultation via approximately 6,300 contacts by letter, telephone, personal visits, and meetings of client organizations.

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## Research

Research completed during the fiscal year:

- skidding logs without removing treetops did not reduce logging productivity or increase damage to residual trees, but also did not reduce fuel loading significantly (p. 7)

Interim reports on ten continuing research projects:

- Medford District BLM withdrawn lands have been classified according to potential solar radiation and water availability to select 36 study sites for determination of regeneration potential. First-year survival of seedlings planted on the first study site (a hot, dry low-elevation site) is over 90 percent (p. 8)
- after the third growing season, survival rates of 1-0 plugs and plug-1 bareroot seedlings planted on a steep southeast slope covered with ravel (rock and timber debris) are higher than survival rates of 2-0 bareroot seedlings at the same site (p. 10)
- machine site-preparation treatments increased first-year seedling survival to an average of 92 percent as compared to 54 percent on unprepared sites (p. 10)
- despite significant differences in seedling morphology caused by undercutting in the nursery, ponderosa pine seedling survival ranges from 96 to 99 percent on a dry south slope 2 years after planting (p. 11)
- one year after planting on a steep, ravel-prone site, burial by ravel was associated with less than 5 percent of the seedling mortality (p. 13)

- shadecards and styrofoam cup stem-protectors increased survival rates of seedlings planted in late spring on a good site, but did not seem necessary for seedlings planted in late winter on a poorer site (p. 14)

- Douglas-fir seedlings planted under a canopy of herbicide-injected hardwoods had higher survival rates, grew better and suffered less moisture stress than did seedlings planted under untreated hardwoods (p. 14)

- Douglas-fir seedlings were planted among resprouting sclerophyll brush to determine whether vigorous vegetation management is needed on tough-to-regenerate sites with skeletal soils (p. 15)

- a prescribed fire increased summer soil-moisture during the first year after burning and reduced tree-planting time (p. 16)

- four replications of a clearcut-shelterwood comparison study have been harvested and planted; four more replications are being harvested this summer. (Fundamental Phase study under PNW leadership, Adaptive Phase cooperating) (p. 17)

Three new projects initiated to address important issues identified by cooperators will ask

- are there alternatives to herbicides that will reduce competition from resprouting brush in new plantations? (p. 18)

- what is the height growth potential of understory Douglas-fir and white fir after overstory removal? (p. 18)

- can we use soil tests to predict Douglas-fir response to nitrogen fertilizer? (Fundamental Phase study under PNW leadership, Adaptive Phase cooperating) (p. 19)

## Technology Transfer and Education

Six well-attended workshops on reforestation, young stand management, and harvesting held across southwest Oregon were:

- How to Plan a Statistically Sound Experiment (Coos Bay, 10 participants)

- Southwest Oregon Forest Weed Ecology Workshop (Grants Pass, 165 participants)

- Basic Cable Harvesting Systems (Roseburg, 34 participants)

- Using Designated Skidtrails for Resource Protection and Logging Efficiency (Roseburg, 40 participants)

- Multispan Skyline Logging Systems (Roseburg, 30 participants)

- Young Stand Management in Southwest Oregon (Medford, 174 participants)

## Publications

Publications produced to reach a larger audience than workshops and consulting reports addressing specialized problems were

- the FIR Report
  (a quarterly newsletter, Adaptive FIR's main vehicle for a rapid transfer of information to clients)

- Using Soil Tests to Predict Douglas-fir Response to Fertilization
  (may be useful in ranking stands for fertilization)
- Managing Soil Compaction in the Pacific Northwest
  (alternatives for minimizing site-productivity losses resulting from harvesting operations)
- Effect of Auger Planting on Survival and Growth of Douglas-fir on Droughty Sites
  (planting method affects survival on a site-specific basis)
- Impact of Auger Planting on Douglas-fir Survival and Growth
  (auger planting may improve survival on some harsh sites)
- Performance of Artificially Shaded Container-Grown Douglas-fir Seedlings on Skeletal Soils
  (shadecards improve survival on some skeletal soils)
- Research and Technology Transfer in Southwest Oregon
  (overview of FIR program)
- Performance of Container-Grown Douglas-fir on Droughty Sites in Southwest Oregon
  (comparison of container-grown seedlings to bareroot seedlings)
- Performance of Three Douglas-fir Stocktypes on a Skeletal Soil
  (1-0 plugs and plug-1 bareroots performed better than did 2-0 bareroots)
- Multispan Logging of Old-Growth Timber in Southwest Oregon
  (old-growth timber was yarded successfully over intermediate supports)
- Average Dry-Season Precipitation in Southwest Oregon, May through September
  (accurate, easy-to-use map)
- Skidding Treetops Attached to Merchantable Logs: Effects on Ground-based Logging Production
  (Logging productivity is not affected)

# Introduction

After five years, there is encouraging evidence of Adaptive FIR's impact on operational reforestation in southwest Oregon. Improvements in seedling quality, planting supervision, site preparation, and vegetation management are leading to increased success in reforestation of land in the Bureau of Land Management's (BLM) Medford District. For example, 1982 first-year stocking surveys show that 83 percent of planted clearcuts met or surpassed stocking targets, an increase from 68 percent in 1980. Furthermore, third-year surveys show that areas planted in 1980 and that received vegetation management thereafter suffered little downfall in plantation stocking.

In Adaptive FIR studies now underway, conifer seedlings continue to survive and grow on harsh sites that have been withdrawn from the Medford District allowable cut base. On one test site, seedling survival 3 years after planting exceeded 80 percent on a steep southeast slope with a skeletal soil and surface layer of ravel. On nine other test sites with first- or second-year results, seedling survival exceeded 80 percent when competing vegetation was controlled. Where site preparation was inadequate or reemerging vegetation not controlled, survival after 2 years dropped as low as 47 percent. (Details reported in FIR Report 5[1]:9-10).

During fiscal year 1983 10 Adaptive FIR research projects have produced information helpful in solving reforestation or stand management problems in the region. These results have been presented through the FIR Report, Adaptive FIR workshops, presentations to local and regional organizations, consultations with clients, contacts with individual resource specialists, and publications in scientific journals.

The following pages summarize significant results and management implications of individual research and educational projects. Each summary is followed by a list of sources that cover the respective project in more detail. Abstracts of 1982-1983 publications are in Appendix A. Quarterly FIR Reports are in Appendix B.

# Research

Completed Research

## Cost and Effectiveness of Skidding Treetops Attached to Merchantable Logs: Effects on Logging Productivity, Residual Stand Damage and Fuel Loading

*Skidding logs without first removing treetops did not reduce logging production or increase damage to residual crop trees, but also did not significantly reduce fuel loading. Results show the need for study of other slash-disposal means.*

Tractor skidding operations often employ designated skidtrails in order to minimize soil compaction. Machine piling of slash after skidding may not be desirable in such cases. Fuel loading may be reduced in these cases by leaving treetops attached to merchantable logs during the tractor skidding operation. However, this practice may cause extra damage to residual crop trees in a commercial thinning, or to existing regeneration during overstory removal.

This study compared results from a commercial thinning-salvage timber sale that involved two treatments: one in which treetops were not bucked from logs along one side of the skidtrail, and another in which the logger was free to buck the tops and leave them in the woods along the other side of the skidtrail.

Logging productivity was not affected by skidding extra-long turns of logs to the landing or by disposing of treetops at the landing. Damage to residual crop trees, which averaged about 13 inches d.b.h., was not significantly different between treatments (about 15 percent of the crop trees were scarred).

However, no significant differences were found between treatment areas in fuel loading after logging. It appears that the larger lower limbs, which were removed from the lower logs and left in the woods in both treatment areas, constitute a large enough portion of the post-logging fuels to outweigh the difference in numbers of tops removed.

At this point, treetop skidding does not appear to increase logging costs, but is also not effective in reducing fuel buildup. Other means of slash disposal should be evaluated carefully. (Details published in FRL Research Note 73, 1982 Adaptive FIR Annual Report, and FIR Reports 4[2]:8-9 and 5[1]:5).

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Continuing Research

## Regeneration Potential of Withdrawn Bureau of Land Management Lands

*Some 2,500 sites have been classified so that study sites can be selected and planted and their regeneration potential determined. First-year survival rates for the first site planted are over 90 percent.*

A study was begun in 1982 to determine the potential for artificial reforestation of timber land withdrawn from the Medford District's allowable cut base. Selection of the 36 test sites to be outplanted is nearly complete. Two sites have already been planted: one in the area of the Tin Pan Peak fire, planted in February 1982, and a second in the Salt Creek area, planted in the spring of 1983.

Bareroot 2-0 and 1-0 plug seedlings of Douglas-fir and ponderosa pine were planted on the Tin Pan Peak site. First-year survival for the plugs was 90 percent for Douglas-fir and 92 percent for pine. For the bareroot seedlings, survival was 99 percent for Douglas-fir and 98 percent for ponderosa pine. Survival halfway into the second year also appears to be quite high. Competing hardwoods, grasses, and gophers on this site were controlled vigorously.

Analysis of the lands withdrawn from the allowable cut land base showed that two administrative categories (low intensity and limited management) could be combined for subsequent analysis (Fig. 1). A statistical technique called principal components analysis revealed that variables associated with water supply and solar radiation accounted for 74 percent of the difference between sites withdrawn from the allowable cut base.

MEANS FOR SITE VARIABLES FOR LOW INTENSITY AND LIMITED USE LANDS

| Class | No. Sites | Average Slope (%) | Average Elev (Feet) | Primary Aspect (Deg.) | Summer Precip. (In.) | Average Available Soil $H_2O$ (In.) | Summer Sunshine (Gram Cal.) |
|---|---|---|---|---|---|---|---|
| Limited Mgmt. | 1563 | 49.3 | 2544 | 96 & 264 | 5.5 | 3.9 | 131390 |
| Low Intensity Mgmt | 906 | 47.2 | 2825 | 98 & 262 | 5.0 | 3.9 | 132770 |

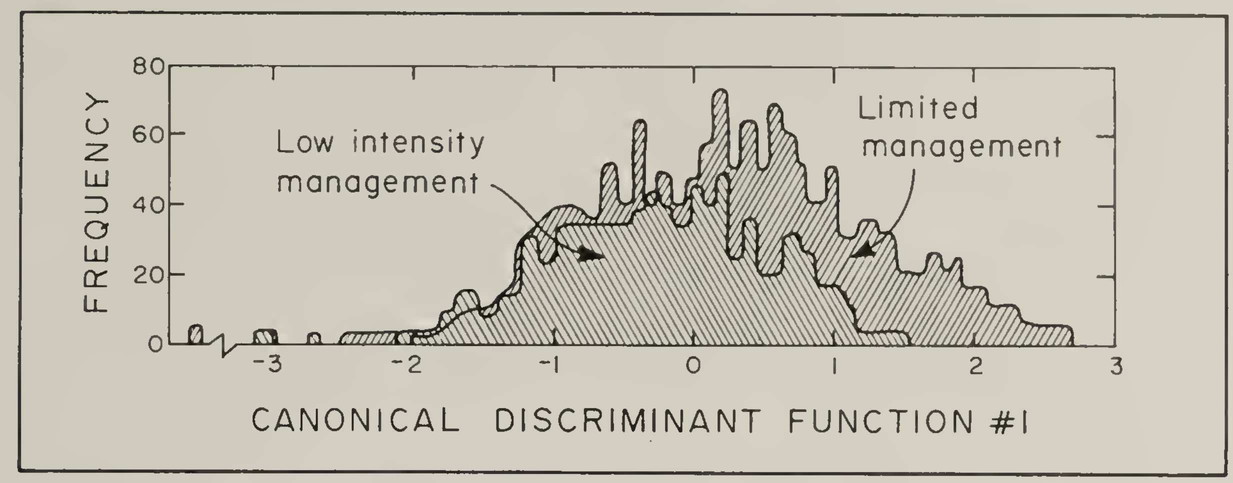


Fig. 1. Comparison of two categories of withdrawn lands by selected site characteristics.

Plotting the frequency of withdrawn sites by two variables--potential solar radiation during the dry season (May 1 to September 30) and by water potentially available to the seedlings--revealed that most sites received high levels of solar radiation (SW, SE, S aspects) and are low in water (Fig. 2). The current plan is to sample six sites near each of the six shaded regions on the radiation-by-water grid shown in Figure 2. Planting has been spread over several years to reduce the influence of uncommonly good or bad growing seasons. (Details reported in the 1982 Adaptive FIR Annual Report and in FIR Reports 3[4]:4; 4[1]:4; 4[4]:4; 5[2]:6-7).

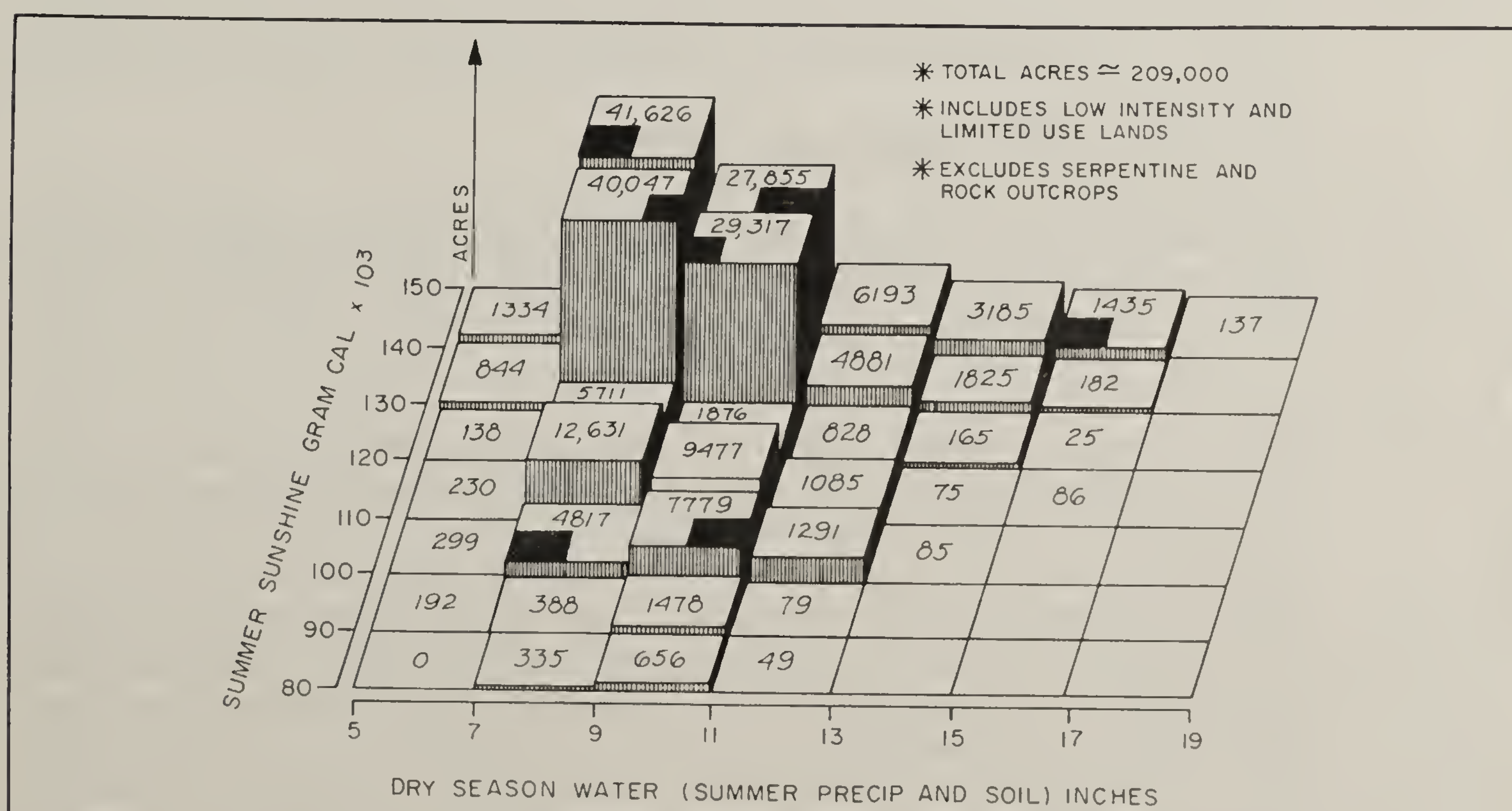


Fig. 2. Acreage of withdrawn lands by summer sunshine and water availability (May 1 - September 30).

## Douglas-fir Stocktype Performance on a Skeletal Soil

*Third-year survival rates of 1-0 plug and plug-1 seedlings outplanted on a harsh site were much higher than survival rates of 2-0 bareroot seedlings on the same site.*

Studies in the Pacific Northwest and British Columbia have shown that differences in seedling stocktypes are associated with differences in field performance, particularly on sites subject to periodic drought. In 1980 an experiment was designed to explore this idea on a site typical of many withdrawn from the Medford District's allowable cut base. Three Douglas-fir stocktypes (1-0 plug, plug-1 bareroot, and 2-0 bareroot seedlings) were planted in 1980 on a steep, southwest aspect. Three years after outplanting, survival of 1-0 plug and plug-1 seedlings exceeded 80 percent while that of the 2-0 bareroot stock exceeded 50 percent (Table 1). The seedlings will be measured and observed for 5 years, through 1984. (Study reported in 1981 and 1982 Adaptive FIR Annual Reports, FIR Report 4[1]:4-5, Tree Planters' Notes 34[3]:11-14, 1982 Proceedings of the Reforestation of Skeletal Soils Workshop, and 1982 Proceedings of the Canadian Containerized Tree Seedling Symposium).

Table 1. Survival of 1-0 plug, plug-1 bareroot and 2-0 bareroot seedlings planted on a harsh site.

| Stocktype | Seedling survival (%) | | |
|---|---|---|---|
| | 1980 | 1981 | 1982 |
| 1-0 plug | 95 | 91 | 86 |
| Plug-1 bareroot | 93 | 87 | 81 |
| 2-0 bareroot | 63 | 56 | 55 |

## Machine Site-preparation

*First-year results indicate that machine site-preparation can be an important tool in successful reforestation, although effectiveness of various types of preparation has not yet been compared.*

This study, inititated in 1981, compared survival rates for 2-0 bareroot Douglas-fir on an untreated control area and on sites prepared with one of four treatments: scarification with a slashrake, scarification plus ripping, surface soil removal with a dirt blade, and soil removal plus ripping. The study site is at 4,000 ft. elevation and on a south aspect; its soil is derived from granidiorite. The site was planted in May 1982 because access to the site was restricted by snowpack.

First-year results show that survival of seedlings was at least 30 percent higher on treated plots than on the control plots (Table 2), despite a late spring drought. A June rain apparently was an impor-

tant factor in seedling survival since most seedlings did not break bud until after the rain. First-year growth was poor, with several seedlings retaining their budcaps until late summer.

Vegetation recovery on the site has been slow, particularly where the soil was removed. There is bare soil on a large portion of each treated plot 1 1/2 years after site preparation. However, only minor erosion appears to have occurred because precipitation, though more than 100 inches per year, has not been intense. (Details published in 1982 Adaptive FIR Annual Report and in FIR Report 4[4]:2-3).

Table 2. First-year survival of 2-0 bareroot Douglas-fir for four types of machine site-prepration.

| Site preparation | Seedling survival (%) Fall 1982 | Spring 1983 |
|---|---|---|
| None (control site) | 57 | 54 |
| Scarification | 95 | 92 |
| Scarification + tillage (rock rippers) | 94 | 93 |
| Soil removal (approx. 2 in.) | 97 | 97 |
| Soil removal + tillage | 88 | 87 |

## The Influence of Undercutting on Seedling Morphology and Field Performance

*Undercutting changed seedling morphology significantly but thus far has not affected survival rates of seedlings planted 2 years ago. Site preparation (ripping) also has not affected survival or growth thus far.*

Undercutting involves drawing a sharp blade through the nursery bed at certain times of the year to sever roots at predetermined depths. This practice is intended to increase lateral root development, decrease height growth and decrease shoot-root ratio. These altered characteristics may increase seedling survival on droughty sites. In the winter of 1980, a study was started at the USDA Forest Service J. Herbert Stone Nursery to evaluate the effect of various undercutting regimes on seedling morphology and field performance.

Douglas-fir and ponderosa pine bareroot seedlings that were starting their second growing season in the nursery received five different undercutting treatments (Table 3). All treatments had substantial impacts on seedling morphology in both species. Test seedlings were outplanted on two droughty sites in the spring of 1981. Untreated 1-0 bareroot seedlings also were planted on the ponderosa pine site for comparison with the treated pine. Despite significant changes in morphology, field survival rates within each of the species have not been significantly different between treatments thus far.

Table 3. Survival of 2-0 ponderosa pine and Douglas-fir seedlings undercut in the nursery in spring 1980 and outplanted on droughty sites in March 1981.

| Undercutting treatment | | | Seedling survival (%) | |
|---|---|---|---|---|
| | | | Ponderosa pine | Douglas fir |
| | Depth | Time | Fall 1982 | Fall 1982 |
| 1. | 15 cm | Start of root growth | 98 | 53 |
| 2. | 15 cm | After budswell, before budbreak | 96 | 39 |
| 3. | 20 cm | After needle expansion | 98 | 51 |
| 4. | 15 m<br>20 cm | Start of root growth<br>After budswell, before budbreak | 98 | 39 |
| 5. | 15 cm<br>20 cm | Start of root growth<br>After needle expansion | 96 | 45 |
| None (control site) | | | 99 | 42 |
| 1-0 bareroot (not undercut) | | | 99 | - |

The effectiveness of soil ripping is also being evaluated on the pine site, which was ripped during site preparation to a depth of about 12 inches. Seedlings representing all five undercutting treatments were planted in and between rip furrows. At the end of 1982, no differences in seedling survival or growth could be attributed to ripping (Table 4).

Both the undercutting and ripping aspects of this study will continue to be measured. (Details reported in the 1981 and 1982 Adaptive FIR Annual Reports and in FIR Reports 2[2] 2-3; 3[2]:3-4; 3[3]:4-5; 4[3]:3-4; 4[4]:2).

Table 4. Percent survival and mean height growth of ponderosa pine stocktypes in ripped and unripped soil.

| Variable | 1-0 Bareroot | | 2-0 Bareroot | |
|---|---|---|---|---|
| | ripped | unripped | ripped | unripped |
| Survival (%) | | | | |
| 1981 | 99 | 100 | 98 | 99 |
| 1982 | 98 | 100 | 96 | 99 |
| Height growth (cm) | | | | |
| 1981 | 4.0 | 4.1 | 5.5 | 4.8 |
| 1982 | 12.8 | 13.7 | 12.6 | 14.3 |

## Ravel Deflection

*Ravel-burial killed very few seedlings protected by experimental deflection devices and by benching. However, results were difficult to evaluate because ravel movement was limited.*

The downslope movement of rock and debris (ravel) has been considered a serious problem in the reforestation of steep slopes with shallow, skeletal soils. A study was initiated in March 1982 to evaluate the effects of three ravel deflection devices on Douglas-fir seedling survival and growth (Table 5). The site is on a 60-70 percent slope, facing southwest, at 2300 ft. elevation, and covered with varying depths of surface ravel up to 10 inches deep. Half of the seedlings in each treatment were planted in a bench, which extended about 8 inches into the slope.

First-year mortality averaged 52 percent across all treatments for a variety of reasons unrelated to burial by ravel. After the growing season ended, less than 5 percent of all seedlings had been buried by ravel. Such limited ravel movement makes it difficult to evaluate treatments, but the shingle-wedge seemed to be the most effective ravel deflection device. Benching was also difficult to evaluate because only four nonbenched trees in the control treatment were buried and two of the benched seedlings were buried (sample size = 192).

Table 5. First-year mortality of Douglas-fir seedlings protected with ravel deflection devices.

| Deflection device | Seedlings buried | | | Seedlings not buried |
|---|---|---|---|---|
| | Dead | Live | Total | Dead |
| | -------percentage of seedlings planted---------- | | | |
| None (control) | 3 | 1 | 4 | 55 |
| 1"x2"x18" stake | 2 | 1 | 3 | 56 |
| 1"x4"x18" stake | 2 | 0 | 2 | 43 |
| Shingle-wedge | 0 | 0 | 0 | 54 |

Ravel may cause more mortality on other ravel-prone sites than it did on this study site. This site was not excessively steep (most slopes less than 70 percent) and a brushfield that developed after logging may have reduced ravel movement. (Details reported in the 1982 Adaptive FIR Annual Report, and in FIR Reports 4[2]:9 and 4[4]:3).

A second site to study ravel is being selected this year. Ravel movement in an old-growth stand will be measured for a year prior to harvest to establish base-level ravel movement. Ravel occurring after timber harvest and site preparation will be measured and the site planted in 1985.

## Effects of Artificial Shade on Douglas-fir Seedling Survival and Growth

*Shading seemed to benefit south-slope plantings of seedlings planted late or that had low vigor. Shading also reduced deer-browsing of seedlings in this study.*

First-year results suggest that artificial shade may not be necessary for good survival rates on south-facing slopes if 2-0 bareroot Douglas-fir seedlings are planted properly in late winter. However, shading appears to be more beneficial if seedlings are planted late or if seedling vigor is low. Under the latter conditions, shading the root collar area with cheap styrofoam coffee cups may be more cost-effective than using the more biologically effective, but more costly, shadecards.

These conclusions are based on first-year survival results from two study areas (Table 6). The Lick Gulch site was planted by a very good crew in February 1982. The Julie Creek site was not planted until mid-May 1982 because of snowed-in roads, and was planted by an inexperienced crew. Shadecards also significantly reduced deer-browsing at the Julie Creek site. Deer browsed 32 percent of the seedlings without shadecards, but only 10 percent of the seedlings with shadecards. (Details reported in the 1982 Adaptive Fir Annual Report and in FIR Reports 3[4]:4; 4[4]:4 and 5[1]:5-6).

Table 6. First-year (1982) survival, by shade treatment.

| | Seedling survival (%) | | | |
|---|---|---|---|---|
| Study area | No shade | South shadecard | East shadecard | Styrofoam cup |
| Lick Gulch (withdrawn land) | 95 | 100 | 99 | 99 |
| Julie Creek (good site) | 59 | 84 | 72 | 75 |

## Hardwood Overstory Injection - Douglas-fir Underplanting Study

*Doudlas-fir planted under sclerophyll hardwood stands had better survival rates, grew more, and experienced lower plant moisture stress when overstory hardwoods were injected with triclopyr amine herbicide.*

This study was initiated in 1982 to test whether hardwood stands composed of madrone, tanoak and chinkapin could be converted to Douglas-fir by underplanting without the benefit of herbicides. Some plots were injected with herbicides in September 1981. In May 1982, 1-0 plug and 2-0 bareroot seedlings were planted in the herbicide-treated and control plots. The interaction between the two stocktypes and the

herbicide treatment was very interesting. The 1-0 plugs in the injected and control stands showed very similar first-year survival and growth rates. However, the 2-0 bareroots in the control stands did not fare as well (Table 7).

Table 7. First-year (1982) survival and growth of seedlings planted under herbicide-treated and untreated stands.

| Treatment/Stocktype | Survival (%) | Height growth (in.) (unbrowsed seedlings) |
|---|---|---|
| Injected hardwoods | | |
| 1-0 plugs | 95 | 3.8 |
| 2-0 bareroots | 90 | 2.1 |
| Control | | |
| 1-0 plugs | 94 | 3.0 |
| 2-0 bareroots | 66 | 1.1 |

Moisture stress showed similar trends. The 2-0 bareroots under the control stands showed the greatest predawn moisture stress levels, reaching peaks of -25 bars in September compared to -15 bars for the plugs. Under the injected stands moisture stress remained between -5 and -9 bars for both stocktypes during the growing season. General guidelines indicate that beyond -6 to -8 bars root growth is inhibited, and beyond -25 bars water-stress-related mortality may occur if recovery is delayed. These known effects of moisture stress on photosynthesis and root and shoot growth indicate that future survival and growth should be far better under the injected stands.

Because of deer browsing, the study was replanted with 1-0 plug and 2-0 bareroot seedlings in March 1983. This will delay second-year data, but will provide an important check on first-year results. Early season measurements of moisture stress resemble the first-year results: the bareroots under the uninjected hardwoods are under the most stress. (Study reported in the 1982 Adaptive FIR Annual Report and in FIR Report 4[4]:3-4).

## Impact of Sclerophyll Brush Removal on Soil Moisture, Temperature, and Residual Vegetation

*Initial results of study indicate that brush conditions affect plant moisture stress levels in Douglas-fir seedlings.*

This project, which is in its second phase, evaluates the effects of four intensities of resprouting sclerophyll brush competition on Douglas-fir seedling survival, growth and plant moisture stress. The

results should help determine the need for vigorous vegetation management on tough-to-regenerate sites. The study area is at 3,600 ft. elevation on a west aspect with a 66 percent slope. The soil is a skeletal Xerochrept with a surface mantle of ravel.

In March 1983, 1-0 Douglas-fir seedlings (4 in.$^3$ plugs) were hoe-planted in areas with the following brush conditions:

1. Brush removed, first-year resprouts killed in late spring (maximum soil moisture, no shade)

2. Two-year-old resprouts killed (maximum soil moisture, some dead shade)

3. First-year resprouts (reduced soil moisture, some live shade by late summer)

4. Fourth-year resprouts (minimum soil moisture available to seedlings, live shade immediately)

Plant moisture stress (PMS) measurements were made in June and August 1983 to establish maximum stress levels under different brush intensities. In June, predawn PMS levels averaged -5 bars for all treatments, but the mean daily maximum ranged from -11 bars for Treatment 1 to -18 bars for Treatment 4. In August, predawn PMS levels remained lower than -10 bars for Treatments 1, 2 and 3. Predawn PMS levels exceeded -20 bars for seedlings planted among the fourth-year resprouts (Treatment 4). Live shade did not counteract the additional water use by the fourth-year resprouts.

Seedlings used for June PMS measurements were excavated for root growth comparisons between treatments. Additional trees will be selected in late fall 1983 for root growth measurement. Seedling survival and growth will be evaluated for several years. (Details on the ecology of the brushfield reported in the 1981 and 1982 Adaptive FIR Annual Reports and FIR Reports 3[3]:2-3; 4[2]:9-10 and 5[1]:5).

## Prescribed Fire

*Burning increased moisture in the top 12 inches of soil and halved planting time.*

The use of prescribed fire is increasing throughout southwest Oregon because of the need to improve site preparation and access to sites for tree-planting. In many instances, fire is viewed as the only method available for site preparation on steep slopes. However, many foresters feel that fire may reduce productivity of steep slopes with thin soils.

An evaluation of the effects of fire on harsh sites began in June 1982. A site east of Selma with shallow, skeletal soil was split in two: half of the unit was burned, and the other half left unburned for comparison. The objective of the study was to determine whether

burning changes planting cost, seedling survival, vegetation response, fuel concentrations, and soils.

Burning decreased immediately the infiltration capacity of the soil, primarily because it increased the soil's water repellency. However, infiltration capacity was not reduced to critical levels and remained well above anticipated storm intensity rates. Water repellency was very spotty; it often showed extreme variability over a distance of only 1 inch and decreased after the first few fall storms.

The summer after burning, soil moisture in the upper 12 inches of soil in the burned areas remained greater than in the unburned control areas. Burning eliminated many early spring resprouts of sclerophyll brush, delaying vegetation recovery in the burned portion of the unit. Vegetation measurements in the fall of 1982 showed that resprouts were taller and covered more area in the unburned unit.

The burned and unburned portions of the unit were planted in February 1983. Planting of 2-0 bareroot Douglas-fir seedlings in the burned portion took half the time required for planting of the unburned portion. A FIR planting crew replanted a portion of each unit to evaluate planting quality.

Soils collected one year after the burn will be analyzed for nitrogen and organic matter and compared with pre- and post-burn soil samples. (Study reported in the 1982 Adaptive FIR Annual Report.)

The effects of prescribed fire will also be evaluated for another site, in the west fork of Evans Creek. The soils are coarse textured and derived from granitic parent material. The study will again compare burned to unburned areas. The site will be burned in the fall of 1983, if possible.

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Cooperative Study with Fundamental FIR

## Reforestation Systems for Douglas-fir in the Siskiyou Mountains

*This study will compare seedling survival and growth in clearcut and shelterwood systems.*

This study will evaluate the effects of clearcut and shelterwood reforestation systems on the survival and growth of Douglas-fir seedlings. Thus far four replications have been harvested, site prepared and planted. Another four are being harvested in the summer and fall of 1983 and are scheduled for planting in 1984. Within each system, the effects of prescribed fire, seedling stocktype, and artificial shade on seedling survival and growth will also be compared. This study will provide information that is important in the development of site-specific reforestation prescription guidelines.

This study is led by the USDA Forest Service Pacific Northwest Forest and Range Experiment Station and represents a major cooperative effort by PNW, Adaptive FIR, and the Bureau of Land Management. The study was first reported in the 1982 Adaptive FIR Annual Report.

New Research

## Alternative Methods of Controlling Sclerophyll Brush Resprouts

*This study will compare the effects of various slashing methods on seedling survival and growth.*

This study will evaluate several methods of slashing employed to control resprouting sclerophyll brush species in the Siskiyou Mountains. Work will focus on clearcuts that were broadcast-burned prior to planting with Douglas-fir seedlings and on which brush has resprouted. Emphasis will be placed on determining the timing and frequency of slashing operations that maximize seedling survival and growth. The timing of slashing treatments will be based on the occurrence of distinct phenological events in brush development and levels of xylem pressure potential. These treatments will be compared with a herbicide prescription and an untreated control. The study will consider the response of Douglas-fir to the various treatments and will also cover brush recovery. Plans call for treatment observations through 1988.

## Growth Potential of Released Understory Conifers

*A comparison of clearcutting-and-planting with management of regeneration that existed before overstory removal. Comparison will facilitate evaluation of trade-offs associated with each practice.*

Two strategies for reforesting sites--clearcutting with planting, and management of regeneration that existed before overstory removal--each have costs and benefits. It is sometimes difficult for managers to evaluate the trade-offs associated with each strategy and thus to select the best one. Many older partial cuts in southwestern Oregon are now stocked, but some seedlings have become suppressed in the understory. Concurrently, reforestation following clearcutting is becoming increasingly successful, and many foresters consider it more efficient to prepare the site and plant than to save suppressed regeneration.

The results of this study will enable managers to make better evaluations of the trade-offs between clearcutting-and-planting and management of existing regeneration. The results will provide a means of predicting the height growth potential of understory Douglas-fir and white fir reproduction after shelterwood overstory removal. The information on growth potential will be dove-tailed in the future with studies evaluating harvesting techniques in relation to seedling mortality during overstory removal. Thus, these two important elements in the decision to manage advanced regeneration can be analyzed together.

The study will sample stands that received an overstory removal at least 5 years ago. Site selection and stem analysis begin in the fall of 1983.

Cooperative Study with Fundamental FIR

## Evaluation of a Mineralizable Soil Nitrogen Test for Predicting Fertilizer Response

*This study is designed to develop soil tests to identify southwest Oregon sites that will respond to nitrogen fertilizer and thus aid in efficient and productive fertilization.*

The current inability to identify sites in southwest Oregon that will respond to nitrogen fertilizer is limiting the use of fertilizer to increase fiber production. A soil test that correlates well with fertilizer response is used in some areas of the Pacific Northwest to identify stands for fertilization. However, differences in soil and site conditions preclude extrapolation to southwest Oregon. This study is designed to develop local correlations so that the soil tests can be used in southwest Oregon. The study will use data on fertilizer response from existing test sites in southwest Oregon. Soil samples will be collected from each site and analyzed for anaerobic mineralizable nitrogen to develop local correlations that can be used to predict Douglas-fir response to nitrogen fertilizer.

The study is being led by the Pacific Northwest Forest and Range Experiment Station. USDA Forest Service and BLM soil scientists are assisting by collecting the soil samples.

# Education

## Reports

The quarterly FIR Report mailing list was cut in 1982 to about 600 subscribers. However, tremendous interest in the research newsletter has pushed the printing of the Fall 1983 issue to nearly 1,200 copies. We regularly receive letters from both public and private land managers and consultants commenting on the utility and timeliness of information in the FIR Report.

The newsletter is our main vehicle for quick transfer of research and education information to FIR clients. Research results from both Adaptive and Fundamental FIR projects, as well as results from other organizations and administrative studies, are presented in the FIR Report. We try to provide information from anywhere in the world that will help solve reforestation or forest management problems in southwest Oregon. Recent articles have discussed such subjects as stocktype selection on harsh sites, vegetation management, planting-site microclimatology, seedling survival during logging, multispan logging, logging productivity, and seedling survival associated with different types of site preparation.

The FIR Report also alerts readers to scheduled education programs and recent publications pertaining to southwest Oregon forestry. The four reports published during fiscal year 1983 are in Appendix B.

In addition to the FIR Report and published, widely-distributed papers on specific research, Adaptive FIR reports on subjects of special

interest to clients. During the past year, two such reports were written. Their abstracts appear below:

McNabb, D. H. 1982. Using soil tests to predict Douglas-fir response to fertilization.

Forest managers are very interested in the use of soil tests to predict fertilizer response. This report reviews basic principles of soil testing and evaluates current uses of the anaerobic incubation method to determine mineralizable nitrogen. Additional research is needed before this method can be used by managers in deciding which stands they should fertilize. At present, it should be used judiciously and in conjunction with other known factors related to fertilizer response.

Froehlich, H. A. and D. H. McNabb. 1983. Managing soil compaction in the Pacific Northwest.

Soil compaction during harvesting with ground-based skidding machines leads to long-term losses of site productivity in the Pacific Northwest. Numerous strategies have been employed to minimize these losses, including switching to more expensive cable or aerial harvesting systems. However, most efforts have attempted to restrict or modify the use of skidding machines. These efforts include identifying soils most susceptible to compaction; limiting the use of machines to a specific season, setting a maximum soil moisture content for machine use, and requiring the use of low-ground-pressure machines. Operationally, these approaches have been cumbersome to implement. More importantly, recent research indicates that these approaches are not effective in reducing the amount of soil compaction. Therefore, they are being abandoned in favor of reducing the area of compacted skidtrails. Harvesting timber from preplanned skidtrails that cover only a small portion of the stand results in a minimum loss of site productivity from managed forest stands and has a negligible impact on logging costs.

## Consultation

Personal contact between Adaptive FIR specialists and individual foresters, resource specialists, scientists, and professional organizations is important in transferring information to FIR clients. Personal contact is also important in keeping Adaptive FIR members up to date on client needs and new research information. Adaptive FIR uses telephone conversations, office visits, field trips, meetings and workshops to help individuals solve specific problems and to inform large groups.

Adaptive FIR members made approximately 6,300 contacts during the last year to help individuals solve problems involving reforestation technology, stand management, and timber harvesting. As in past years, most contacts concerned the reforestation of droughty sites, including methods of site preparation, vegetation management prescriptions, stocktype selection, regeneration harvest system selection, and harvest methods for overstory removal. There were more requests than in

past years for information about timber sale layout and design, multispan analysis, growth and yield, fertilizer prescriptions, design and use of designated skidtrails, and precommercial and commercial thinning prescriptions.

## Professional Programs

Adaptive FIR specialists were asked to present research results to southwest Oregon foresters, resource specialists, managers, and administrators at a number of professional meetings held during the past year. Those meetings, workshops or conferences were: SAF Chapter meetings in Oregon and California; annual meeting of the Oregon State Society of SAF; SOTIA Timber Committee; Douglas County Timber Operators; FIR cooperators in the Roseburg area; OSU Extension workshops in Coos Bay, Corvallis, Eugene, and La Grande; Silviculture Institute; Western Forestry and Conservation Association; Oregon Logging Conference, and the Northwest Forest Soils Council.

## Adaptive FIR Workshops

Six Adaptive FIR-sponsored educational programs trained and informed 453 participants.

How to Plan a Statistically Sound Experiment, October 20-22, 1982. Coos Bay. 10 participants.

The program emphasized fundamental statistical concepts important to foresters who design their own administrative studies. Experimental design, data analysis techniques, and the meaningful interpretation of results were discussed. This workshop was sponsored by Adaptive FIR and Dr. Susan Stafford, biometrician in the Forest Science Department of Oregon State University.

Southwest Oregon Forest Weed Ecology Workshop, November 9, 1982. Grants Pass. 165 participants.

The workshop covered the basic ecology, competitive effects, and methods of control of major forest weeds found in southwest Oregon. Participants were silviculturists and foresters involved in vegetation management during reforestation and stand establishment.

Basic Cable Harvesting Systems, March 29-31, 1983. Roseburg. 34 participants.

For those not specifically trained in logging technology, timber harvesting operations may often seem confusing. However, it is vitally important that everyone in the forest land management team understand the basic capabilities and limitations of methods used to cut and transport timber crops. This 3-day program provided participants with a basic understanding of cable harvesting operations necessary in beginning timber management and engineering positions for government land management agencies and private industry.

Using Designated Skidtrails for Resource Protection and Logging Efficiency, April 29, 1983. Roseburg. 40 participants.

Planning and designating skidtrails before logging starts is becoming important in reducing soil compaction and minimizing the loss of site productivity during timber harvesting. This workshop sharpened skills important in laying out designated skidtrails. Participants were harvest planners, contract administrators and loggers.

Multispan Skyline Logging Systems, June 2, 1983. Roseburg. 30 participants.

Multispan skyline logging is becoming increasingly important in the Pacific Northwest as a means of getting to timber that is inaccessible by conventional systems. This workshop gave timber harvest planners, project layout foresters, road engineers and loggers basic information on the capabilities and limitations of this harvesting method. The workshop included lectures on rigging configurations, intermediate support types and project layout considerations, and field applications, including the rigging of an intermediate support.

Young Stand Management in Southwest Oregon, June 14-16, 1983. Medford. 174 participants.

The first day of the workshop gave participants state-of-the-art information about young stand growth, density management techniques, yield projection, and economic analysis. The second and third days included a field trip to view research installations and operational practices, and exercises on computer simulation and economic analysis.

# Budget Summary

## Fiscal Year 1983

| Estimated Expenditures | | Revenue Sources | |
|---|---|---|---|
| Personnel | $249,213 | Bureau of Land Management | $300,000 |
| Services and supplies | 21,500 | USDA Forest Service | 35,000 |
| Travel | 28,000 | Industry | 18,175 |
| Equipment | 20,000 | Oregon State University | 24,275 |
| Indirect costs | 58,951 | Counties | 18,400 |
| Total | $377,664 | Total | $395,850[1] |

[1]Unexpended funds will be applied to the FY 1984 budget.

# Appendices

## A. Publication Abstracts

Hobbs, S. D. 1982. Effect of auger planting on survival and growth of Douglas-fir on droughty sites. Forest Research Laboratory, Oregon State University, Corvallis. Research Note 72. 6 p.

Two-year-old Douglas-fir bareroot seedlings were hoe- and auger-planted on droughty south and southwest aspects in southwest Oregon. After two years, no differences in height, diameter, or seedling biomass could be detected. Auger-planted seedlings survived significantly better on the southwest aspect.

Hobbs, S. D. 1982. Impact of auger planting on Douglas-fir survival and growth. P. 74 in Exec. Sum. Proceedings of the 1981 Western Forestry Conference. Western Forestry and Conservation Association.

After 2 years on a southwest aspect, survival of auger-planted Douglas-fir seedlings was 30 percent greater than that of hoe-planted seedlings. There were no survival differences between planting methods on an adjacent south slope. There were no growth differences on either site.

Hobbs, S. D. 1982. Performance of artificially shaded container-grown Douglas-fir seedlings on skeletal soils. Forest Research Laboratory, Oregon State University, Corvallis. Research Note 71. 6 p.

One-year-old container-grown Douglas-fir (*Pseudotsuga menziesii* [Mirb.] Franco) seedlings were outplanted on north, east, south, and west aspects on steep, skeletal Xerochrepts in southwest Oregon. After 2 years, survival rates were highest on north and south aspects, but biomass production (dry weight) was greatest on the west aspect. Shadecards, used to artifically shade half of the seedlings on each aspect, increased survival by 27 percent on the south aspect but had little effect elsewhere. Shadecards significantly increased height growth on the west aspect but affected height less on the south aspect. These results and those of other studies suggest that shadecards may increase Douglas-fir seedling survival under certain conditions.

Hobbs, S. D., J. C. Gordon, and G. W. Brown. 1983. Research and technology transfer in southwest Oregon. Journal of Forestry 81(8):534-536.

A cooperative program designed to intensify research and technology transfer has developed as a result of local demand to address severe reforestation problems in southwest Oregon. The Forestry Intensified Research (FIR) Program, begun in 1978, has two distinct, interrelated phases: (1) Fundamental FIR, in which scientists conduct basic research at off-site research centers, and (2) Adaptive FIR, in which forestry specialists conduct adaptive research and education programs as an interdisciplinary team in the problem area. Establishing the local team has done more to ensure effective technology transfer than any other single factor.

Hobbs, S. D., D. P. Lavender, and K. A. Wearstler, Jr. 1982. Performance of container-grown Douglas-fir on

droughty sites in southwest Oregon. P. 373-377 in Proceedings of the Canadian Containerized Tree Seedling Symposium. J. B. Scarratt, C. Glerum and C. A. Plexman, eds. Canada-Ontario Joint Forestry Research Committee Proc. O-P-10.

First-year growth and survival data from two plantations of container-grown and bareroot Douglas-fir (Pseudotsuga menziesii [Mirb.] Franco) seedlings on hot, dry sites in southwest Oregon are discussed. The container-grown plants demonstrated better shoot and root growth and higher survival than the bareroot seedlings in both plantations.

Hobbs, S. D., and K. A. Wearstler, Jr. 1983. Performance of three Douglas-fir stocktypes on a skeletal soil. Tree Planters' Notes 34(3):11-14.

Two years after outplanting, survival of Douglas-fir 1-0 plug and plug-1 bareroot seedlings on a steep, skeletal soil in southwest Oregon exceeded that of 2-0 bareroot stock by 35 and 31 percent, respectively. Height and diameter growth did not differ despite large differences in the initial size of stocktypes.

Lysne, D. H. and S. E. Armitage. 1983. Multispan logging of old-growth timber in southwest Oregon. Research Note 74. Forest Research Laboratory, Corvallis, Oregon.

Multispan yarding systems have not been widely used for harvesting timber in southwest Oregon. In this case study a 6-acre stand of old-growth timber considered typical of southwest Oregon was clearcut with a multispan skyline system using one support per road and a live skyline. One single-tree and one double-tree support system were used. Each required approximately 4 hours to rig completely. Net production averaged 25 Mbf per day while logging over either type of support. The carriage passed a 7.5° deviation from span alignment in the double-tree support system but not a 12.25° deviation in the single-tree system. Support-line tensions measured in the single-tree system exceeded predicted tensions. Support-line tensions measured during inhaul were greatest when the carriage was immediately uphill from the jack and were lowest when the carriage crossed the jack.

McNabb, D. H., H. A. Froehlich, and F. Gaweda. 1982. Average dry-season precipitation in southwest Oregon, May through September. Extension Service EM 82-26. Oregon State University, Corvallis. 7 p. + 1 map.

Dry-season precipitation is defined as that occurring between May 1 and September 30, a period when potential evapotranspiration exceeds precipitation throughout the interior valleys of southwest Oregon. Data were collected from 62 precipitation stations with monthly records and another 35 stations with annual records where dry-season preciptation was estimated from the regional average of percent of the annual precipitation occurring during the dry season. Dry-season precipitation is approximately 12.8 percent of the average annual precipitation, although the percent varies across southwest Oregon. Dry-season precipitation is lowest in the interior valleys; the Rogue Valley receives approximately two-thirds the dry-season rainfall that occurs on similar elevation sites in the Umpqua Valley. The variation in dry-season precipitation across southwest Oregon, coupled with the consistency of potential evapotranspiration, makes it a useful predictor of the region's dry-season climate.

Tesch, S. D. and D. H. Lysne. 1983. Skidding treetops attached to merchantable logs: effects on ground-based logging production. Research Note 73. Forest Research Laboratory, Oregon State University, Corvallis. 6 p.

Logging productivity when treetops are left attached to merchantable logs and skidded to a central landing is compared with productivity when treetop skidding is not required. In a commercial thinning-salvage timber sale where designated skidtrails were used, skidding of attached unmerchantable treetops took no extra skidding time, and the delays associated with top disposal at the landing did not cause a significant loss of production. Comparisons of skidding times when the skidder left designated skidtrails to choker logs versus turns when the winch line was pulled to logs from the skidtrail indicated no significant difference in time per turn.

## B. FIR Report
## A quarterly publication, mailed free upon request.
## 1301 Maple Grove Drive
## Medford, OR 97501

# FIR Report

## FALL 1982

VOL. 4 NO. 3

"FIR REPORT" is a quarterly publication containing information of interest to individuals concerned with forest management in southwest Oregon. It is mailed free on request. Requests should be sent to: FIR REPORT, 1301 Maple Grove Drive, Medford, Oregon 97501.

FIR REPORT communicates recent technological advances and adaptive research pertinent to southwest Oregon, and alerts area natural resource specialists to upcoming educational events. Comments and suggestions concerning the content of "FIR REPORT" are welcome and should be sent to the Maple Grove address.

The Southwest Oregon Forestry Intensified Research Program (FIR) is an Oregon State University, School of Forestry program designed to assist region foresters and other specialists in solving complex biological and management problems unique to southwest Oregon. FIR specialists organize, coordinate, and conduct educational programs and adaptive research projects specifically tailored to meet regional needs.

Established in October, 1978, the FIR project is a cooperative effort between Oregon State University, the Bureau of Land Management, U.S. Forest Service, O & C Counties, and southwest Oregon timber industries. It represents a determined effort by the southwest Oregon forestry community and county governments to find practical solutions to important forest management problems.

For the FIR Staff,

Steven D. Tesch
Silviculture Specialist

## Inside



OREGON STATE UNIVERSITY EXTENSION SERVICE

FORESTRY INTENSIFIED RESEARCH

SERVING SOUTHWEST OREGON THROUGH ADAPTIVE RESEARCH AND EDUCATION

## FIR Specialists

OLE HELGERSON, Silviculture
STEVE HOBBS, Reforestation
DAVE LYSNE, Harvesting
DAVE McNABB, Watershed
STEVE TESCH, Silviculture

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# Current Research

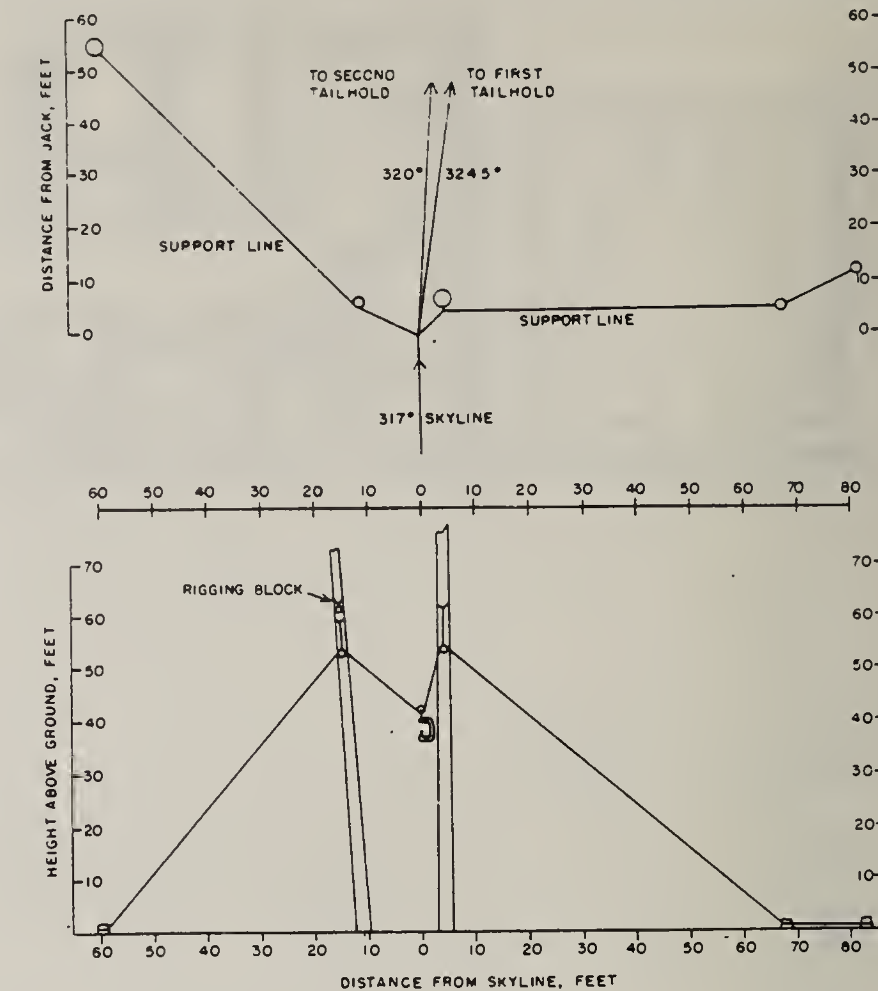
# Adaptive FIR

A CASE STUDY OF MULTISPAN LOGGING OLD GROWTH TIMBER

A new cooperative case study between Adaptive FIR and the Medford District, BLM, has been initiated on multispan logging of old growth timber in southwest Oregon. The logging phase of the study has been completed and the data are being analyzed by Dave Lysne, FIR, and Steve Armitage, BLM, for publication. Some preliminary results are now available.

The six-acre study area, located on the Glendale Resource Area of the Medford District, BLM, was clearcut in June, 1982, by Bud Van Norman of Glendale, Oregon. Based on a 100 percent cruise, the average tree was 28 inches DBHOB and contained 1.1 Mbf gross volume, with the largest trees being 64 inches DBHOB. The sale averaged 31.8 Mbf net volume per acre. Bud's yarder, carriage, and jack were all custom-made, but are typical of equipment commercially available. The yarder has a 1 1/4-inch skyline, and a 7/8-inch mainline, a 5/8-inch haulback, and a 7/16-inch strawline. The carriage is similar to a large open-sided Christy.

Two intermediate support settings were used to log the unit, a double tree support system (Figure 1) and a single tree support system (Figure 2). Bud would rig the skyline through a support and tie the skyline off to a convenient temporary tailhold so yarding could proceed while the ultimate tailhold was rigged. All tailholds are shown in the figures.



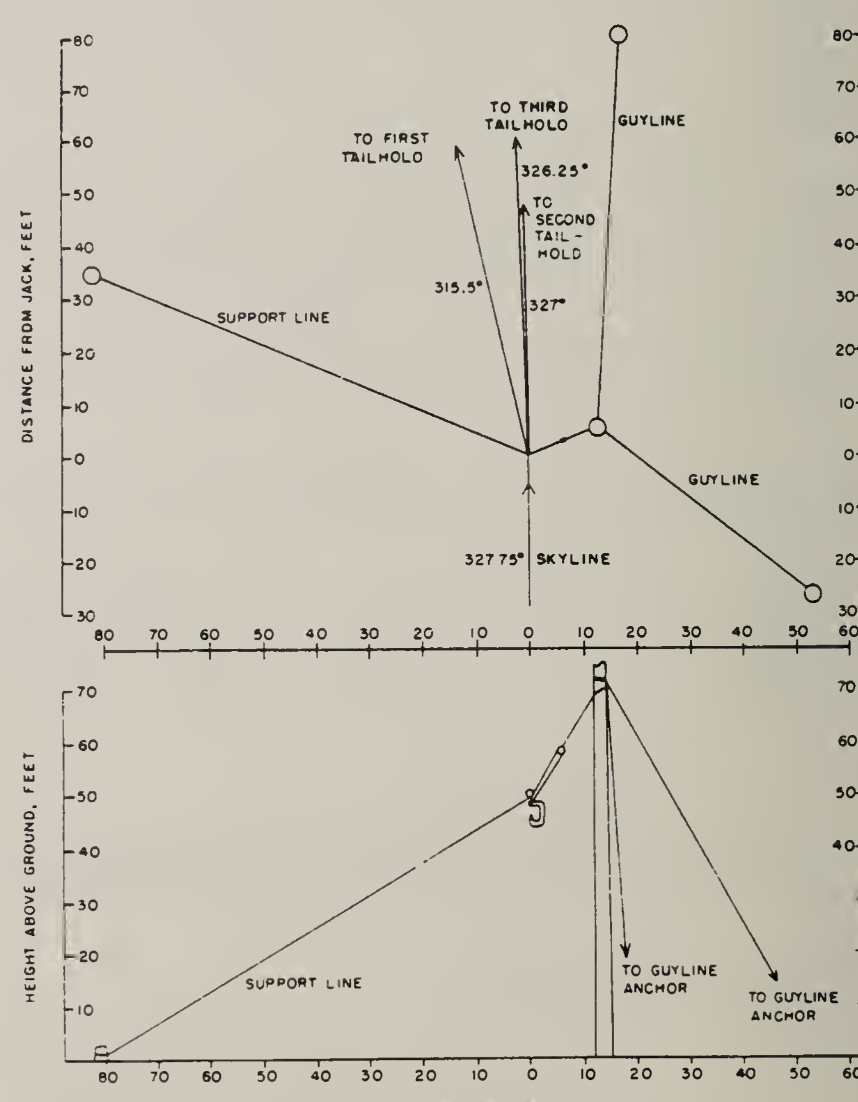




Figure 2. Single tree support system. The jack has been enlarged to show detail.

Each support system required four hours to fully rig. However, future supports could probably be rigged in three hours with a hooktender, a choker setter, a yarder engineer, and a live strawline from the yarder.

As shown in the figures, the skyline spans were not colinear. In Figure 1, the 7.5 degree deviation from span colinearity has caused the jack to drift towards the right support tree under the influence of the skyline horizontal component. The 7.5 degree deviation from colinearity did not cause a problem with either the mainline rubbing against the right support tree or the carriage or jack impacting the support tree on loaded inhaul (FIR REPORT 3(3):9). The mainline either dug into stumps uphill of the terrain break at the supports, into the soil between the supports or into the base of the right support tree. When the mainline did rub against the support tree, the tree remained stable because the rubbing was at the tree's root collar. As the loaded carriage would approach the support, the weight of the carriage, jack and logs would overcome the horizontal skyline component and the jack would center between the support trees, allowing free passage of the logs. The carriage, however, could not pass the 12.25 degree deviation from span colinearity shown in Figure 2. As the carriage would approach the jack, the weight of the carriage and turn of logs would cause the jack to hang vertically, forcing the skyline to slip out of the groove in the jack. This problem was not observed with the 7.5 degree dogleg, although some wear on the side of the skyline groove in the jack was observed after logging the double tree support setting.

The entire unit was logged in 15 days, including move-in, rigging and move-out, for an average net production of 12.7 Mbf per day, based on the cruised volume. While logging over rigged support trees, net production averaged 25 Mbf per day. In a sample of 35 turns from both the single tree and double tree support settings, net production averaged 5.5 Mbf per hour, excluding scheduled delay time. The use of intermediate supports did not appear to lower production once the supports were rigged.

Bud used a live skyline while logging the unit. As needed, the carriage would be stopped and the skyline retensioned during any phase of the yarding cycle. The skyline fed easily over the jack and through a clip used to secure the skyline on the jack. Neither skyline nor jack wear was apparent as a result of this practice.

Support line tensions for the single tree support system are given in Table 1. All of the data was collected from a setting with a deviation from span colinearity of 0.75 degrees and chord slopes of -39 percent and -59 percent. The highest support line tensions occurred when the carriage was located immediately uphill from the jack and the lowest tensions occurred when the carriage was crossing the jack. A static analysis of support line tensions will predict that the highest support line tension will occur as the carriage crosses the jack. A static analysis may be simulated by stopping the carriage at various places during inhaul, including on top of the jack, and measuring support line tensions. We found, however, that with the carriage traveling at typical logging speeds, dynamic loads greatly exceeded the static loads. As the carriage approached the jack from below, the skyline would form a steep angle up to the jack, causing a high support line tension. Suddenly, the carriage would ascend the skyline and quickly pass the jack. Very little of the carriage and log weights were transferred to the support line as the carriage passed the jack. Once the carriage was uphill from the jack, the skyline slack from the lower span would rapidly flow over the jack into the upper span and the carriage would accelerate into a valley in the skyline's upper span created by the additional skyline length. When all of the skyline slack was transferred to the upper span, the skyline would catch the falling carriage and the support line tension would surge to its highest level.

Table 1. Single Tree Support Tensions.

| Total[1] turn weight | Carriage location: Immediately below jack | Crossing | Immediately above jack |
|---|---|---|---|
| 10.1 | 14.3[2] | 8.7 | 16.1 |
| 6.1 | 13.1 | [3] | 13.8 |
| 5.3 | 13.5 | | 13.7 |
| 5.0 | 13.3 | 9.7 | 13.7 |
| 6.9 | 13.3 | 8.5 | 13.5 |
| 6.8 | 15.5 | | 17.3 |
| 6.7[4] | 13.8 | 9.0 | 14.7 |

[1]Includes carriage, jack and logs (kips).
[2]Kips.
[3]Blanks indicate missing data.
[4]Averages.

A two-dimensional static analysis of support line tensions (using carriage, jack and log weights plus the skyline force on the jack when the skyline is tensioned to the pretension length necessary to obtain the required ground clearance) yields an estimate of 10.8 kips support line tension. A three-dimensional analysis using the same inputs yields an estimated support line tension of 12.9 kips. A desk-top computer program that statistically predicts jack loading for various carriage positions estimates the support line tensions to be 11.0 kips in a two-dimensional analysis and 13.2 kips in a three-dimensional analysis. All estimating procedures overestimated the support line tensions when the carriage crossed the jack and underestimated the maximum tensions resulting from dynamic forces.

Additional information and discussion of the case study results will be published through the Forest Research Laboratory.

D. L.

## PONDEROSA PINE PLANTED IN RIPS

In the spring of 1981, a study was initiated in southwestern Jackson County near Ruch to evaluate the impact of soil ripping as a site preparation method on ponderosa pine seedling survival and growth. Prior to site preparation the site was dominated by manzanita with scattered buckbrush, madrone, white oak, and poison oak. The aspect is south with a 30 percent slope at an average elevation of 610 m. The soil series is Vannoy, a fine-loamy, mixed, mesic Typic Haploxeralf. A D-6 tractor was used to uproot and pile brush into windrows which were burned in the fall 1980. The site was then ripped on contour by a D-4 tractor to an approximate soil depth of 30 cm. Changes in soil bulk density due to ripping have been previously described by Dave McNabb

(FIR REPORT 3(3)4-5). One hundred sixty 2-0 bareroot and 160 1-0 bareroot ponderosa pine seedlings were planted on the test site in the spring 1981. One-half of the seedlings in each stocktype were planted in the rips while the other half were planted mid-way between rips. Planting was done by shovel.

By the end of 1981 survival of both stocktypes was excellent despite a record-breaking heat wave during the summer. No differences in survival could be found for either stocktype due to ripping (Table 1). Likewise, no difference in height growth were detectable after one year although 2-0 seedlings generally produced more height growth than 1-0 seedlings.

Table 1. Percent survival and mean height growth (± s.d.) of 1-0 and 2-0 bareroot ponderosa pine seedlings in ripped and unripped planting spots.

| Stocktype/ treatment | 1981 survival (%) | Initial height (cm)[1] | 1981 growth (cm) |
|---|---|---|---|
| 1-0: ripped | 99 | 7.6 ± 2.3 | 3.9 ± 2.0 |
| unripped | 100 | 8.1 ± 2.5 | 4.1 ± 1.8 |
| 2-0: ripped | 98 | 10.7 ± 3.2 | 5.8 ± 9.6 |
| unripped | 99 | 11.1 ± 3.5 | 5.8 ± 6.9 |

[1]Differences in initial height between ripped and unripped seedlings reflects soil sloughing into the rip furrow shortly after planting.

These results clearly show that under the described test conditions, soil ripping had absolutely no effect on seedling performance as defined by the variables measured. It should be emphasized, however, that this information represents only one year of observation and that conclusions regarding treatment effectiveness should be based on a longer period of study. Consequently, these seedlings will continue to be measured for three or four more years. A report on second-year performance will appear in the winter issue of the FIR REPORT.

S. H.

# Fundamental FIR

## A NEW LOGGING STUDY

A new Fundamental FIR study initiated by George Brown and Dave Perry, Oregon State University, will study a "Comparison of Alternative Harvest Systems in Shelterwood Overstory Removal and Impact on Understory Seedlings." The study objectives are to compare (1) falling and yarding costs and (2) mortality and damage to understory seedlings for dispersed tractor skidding and the use of directional falling and designated skid trails.

One tractor logging timber sale has been selected for study on the Butte Falls Resource Area, Medford District, BLM. If a suitable area can be found, a comparison study will examine the cost and effectiveness of using carefully located skyline corridors and directional falling to reduce understory damage during skyline overstory removal logging. Prelogging data are currently being collected for the tractor study and sites are being examined for inclusion in the companion study.

D. L.

## HERBICIDE DEGRADATION IN SCLEROPHYLL BRUSHFIELD FOLIAGE

Mike Newton and colleagues at Oregon State University have been studying herbicide residues as part of an evaluation of various vegetation management methods in southwest Oregon. Herbicide treatments tested included aerial application of 2,4-D ester, two rates of triclopyr amine, two rates of triclopyr ester, and a mixture of 2,4-D ester with potassium salt of picloram.

Applications were made in 6-8 year old brushfields which had been clearcut. The former Douglas-fir or mixed conifer stands contained brush 1-3 meters tall, dominated by tanoak sprouts. Other species included manzanitas, madrone, golden chinkapin, and varnish leaf ceanothus.

Residue samples were taken from foliage in the upper crowns of primarily tanoak, and from the browse layer in the lower crowns of the same shrubs. Twenty specimens were tagged in each of three replicated plots before treatment. Dates of collection were 0, 18, 37, 79, 153, and 325 days after herbicide application. Metal cups attached to each shrub were used to estimate absolute deposit rate. Samples were analyzed by gas-liquid chromatography with a detection limit of about 0.1 part per million (ppm) wet weight basis. Crown samples of all herbicides contained higher levels of residue than understory foliage which caught from one-half to one-sixth of the canopy deposits. Degradation results indicate all herbicides deteriorated substantially over time (Tables 1, 2). A half-life of less than one month was observed for picloram; 2,4-D was most persistant with a half-life of close to six months. The triclopyr treatments showed initial half-lives of about one month, but degradation slowed after the third month.

Table 1. Concentrations of several herbicides in tanoak canopy foliage from zero to 325 days after application in the Siskiyou Mountains of Oregon.

| Herbicides | kg/ha | Concentration mg/kg Day-1 | 18 | 37 | 79 | 153 | 325 |
|---|---|---|---|---|---|---|---|
| 2,4-D ester | 2.2 | 66 | 40 | 39 | 32 | 28 | 14 |
| | 3.3 | 157 | 107 | 88 | 60 | 53 | 52 |
| Picloram, k salt | 0.55 | 22 | 12 | 7.5 | 1.1 | 1.3 | 2.8 |
| Triclopyr amine | 2.2 | 141 | 122 | 32 | 21 | 16 | 17 |
| | 4.4 | 221 | 150 | 51 | 23 | 26 | 21 |
| Triclopyr ester | 1.65 | 69 | 54 | 35 | 24 | 24 | 23 |
| | 3.3 | 127 | 57 | 59 | 60 | 45 | 37 |

Table 2. Concentrations of herbicides in tanoak understory foliage from zero to 325 days after application in the Siskiyou Mountains of Oregon.

| Herbicides | kg/ha | Concentration mg/kg Day-1 | 18 | 37 | 79 | 153 | 325 |
|---|---|---|---|---|---|---|---|
| 2,4-D | 2.2 | 26 | -- | 10 | 6.3 | 9.0 | 5.8 |
| | 3.3 | 58 | -- | 22 | 21 | 22 | 19 |
| Picloram, K salt | 0.55 | 11 | -- | 9.3 | 1.1 | 0 | 1.1 |
| Triclopyr | 2.2 | 76 | -- | 12 | 9.8 | 7.5 | 6.9 |
| | 4.4 | 49 | -- | 18 | 14 | 14 | 11 |
| Triclopyr ester | 1.65 | 24 | -- | 20 | 8.6 | 11 | 13 |
| | 3.3 | 33 | -- | 29 | 17 | 18 | 11 |

Newton notes that the initial rapid degradation in residues occurred prior to significant fall rains, in a climate where summers can be characterized by intense sunshine. The scientists postulate that the dry environment of the aerial parts of shrubs was not conducive to microbial degradation, and that ultraviolet light-based (photolytic) destructive processes were active. They also noted the ester formulations, which are noted for better entry into the waxy sclerophyll foliage than water soluble salts, degraded more slowly. Once absorbed into the leaf tissue, residues are less exposed to the ultraviolet radiation and would be expected to be more persistant if photolysis were the major degrading process.

S. T.

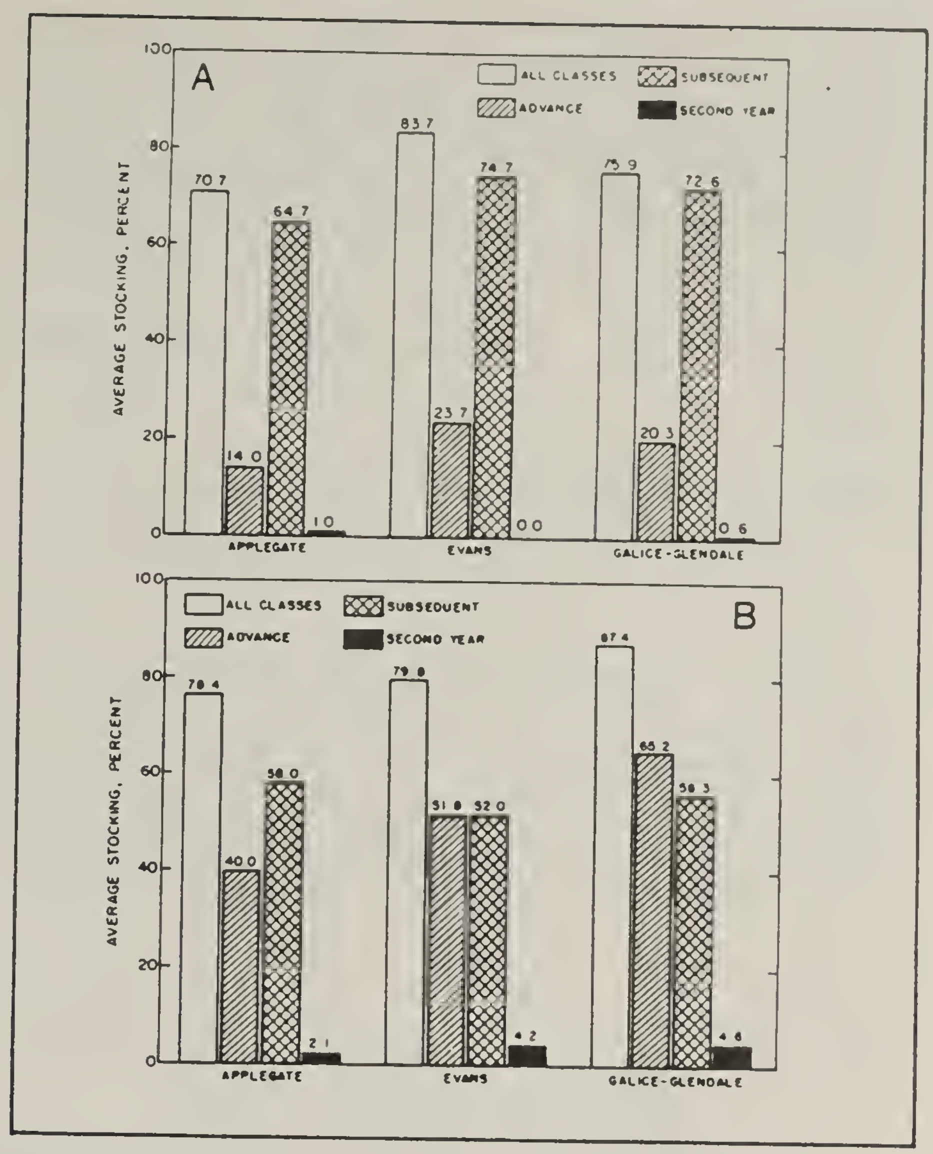



Figure 1. Regeneration in clearcuts (1A) and in partial cuts (1B), by class.

## REGENERATION OUTLOOK ON BLM LANDS IN THE SISKIYOU MOUNTAINS

A comprehensive evaluation of regeneration on BLM lands in the Siskiyous has been completed. This work was similar to that reported on for the southern Cascades in PNW Research Paper PNW-284. Some highlights are presented here; the full report will be published following technical review and editing.

"Both partial cut and clearcut units cutover during 1956-1971 in the Siskiyous were well-stocked with a combination of regeneration that became established before and after harvest cutting (Figure 1). Total stocking varied somewhat among the Applegate, Evans, and Galice-Glendale areas, but averaged 81 percent in partial cuts and 77 percent in clearcuts. In partial cuts, advance regeneration was a sizable component of total stocking. Clearcuts had more regeneration that became established after harvesting than partial cuts, averaging 71 percent subsequent stocking vs. 56 percent.

Douglas-fir was the predominant species of advance and subsequent regeneration in both partial cuts and clearcuts. Incense-cedar, sugar pine, and true firs were commonly present in partial cuts, whereas ponderosa pine was the second most common species in clearcuts. Two or more species were present on one-third of all stocked four-milacre subplots.

Average stocking differed significantly by forest type, soil series, soil origin, soil depth, and stream drainage. In partial cuts, stocking averaged lower in the Douglas-fir forest type than in the sugar pine type. But in clearcuts, stocking was greater in the Douglas-fir type. Stocking tended to be higher than average on soils of granitic origin and lower than average on soils of volcanic origin. Stocking in clearcuts tended to be greater on the deepest soils but did not differ significantly between shallow- and medium-depth soils. Partial cuts in small drainages that flow directly into the middle part of the Rogue River tended to have the highest total, advance, and subsequent stocking. Stocking in clearcuts tended to be higher in the west fork of Cow Creek than elsewhere.

Stocking was correlated with an array of environmental variables. However, the correlations tended to differ between partial cuts and clearcuts and between the Applegate, Evans, and Galice-Glendale areas. In both partial cuts and clearcuts, stocking usually decreased 1) as slope increased; 2) as amount of logs, wood, bark, increased, and 3) as the cover of woody perennials increased. Higher stocking was generally but not always associated with greater precipitation. Stocking tended to be higher on slopes most exposed to the sun in partial cuts and on those least exposed to the sun in clearcuts.

From the array of stocking, environmental, and statistical data, I concluded that regeneration responses

differ in the Applegate, Evans, and Galice-Glendale areas. Reforestation can be improved by paying greater attention to forest types, soil series, and differences in local tree and plant communities when selecting cutting method and reforestation techniques. For maximum results, cutovers must be reforested promptly, competition from vegetation must be controlled, and damage from animals must be kept at a reasonable level."

William I. Stein
PNW Experiment Station, Corvallis

## COARSE FRAGMENT VARIABILITY ON STEEP SLOPES

Soil variability within specific landscape units of the Umpqua National Forest is being studied by Ron Myhrum and Herb Huddleston, OSU Department of Soil Science. Their objective is to quantify and determine the causes of variability in particle size distribution. This variability, particularly in coarse fragment content, contributes to the reforestation problems on many sites in southwest Oregon. Coarse fragment content of a soil is important because it reduces the water holding capacity of the soil and decreases plantability. Both factors are considered when determining whether commercial forest land can be successfully reforested.

Four sites have been selected on the Umpqua National Forest. These sites have steep slopes and soils mapped as Soil Resource Inventory units 27 and 51. These soils are shallow to moderately deep, gravelly to very gravelly loams, silt loams and clay loams.

One hundred sample points were established on each site. Sample points were located on a 10 by 10 point grid with a grid spacing of 15 m. A surface mineral soil sample and a subsoil sample were collected at each point. Slope gradient and slope convexity or concavity were recorded for each point. The particle size distribution, based on the whole sample was separated into the following size fractions > 3", 1 1/2-3", 3/4-1 1/2", 3/8-34", 5 mm-3/8", 2-5 mm, sand, silt, and clay.

Considering the data from all sites, the most variable property, as indicated by the coefficient of variation, was the coarse fragment fraction > 3 inches. This was consistent across all sites and for both A and B horizons; however, examination of the data revealed that for each site and particle size class, several of the sampling points contained none of a given particle size class. Zero content of sand, silt, and clay occurred when sampling points fell on bedrock outcrops or on tallus rubble. Averaging zero values with non-zero values gave a distorted impression of the true mean and variability of each size fraction for areas where soil occurred and planting may be considered.

Omitting zero entries from the calculations only increased mean values of the fine soil fractions (sand, silt, and clay) from 2 to 5 percent but decreased the coefficient of variation from about one-third to one-half. Omitting zero entries from the four smallest coarse fragment contents (2 mm-3/4 inch) had a minor effect on the means and coefficients of variation, probably because they are random occurrences, although some zero entries were associated with tallus rubble dominated by larger coarse fragments.

Zero values had a significant impact on the mean and coefficient of variation of the two largest coarse fragment sizes. About 30 percent of all samples lacked the 1 1/2-3" size class and 83 percent of the samples lacked the > 3" size class. Excluding these values increases the mean to nearer the median of the values which do occur and reduces the coefficient of variation by up to 79 percent.

Myhrum and Huddleston have formulated a two-stage sampling scheme for helping to account for zero size classes. The first stage of the procedure involves a quick survey to determine the amount and location of bedrock outcrops. This step is also useful for determining what proportion of a unit can be considered forested land. The second stage involves retraversing the site and sampling the soil between rock outcrops.

Two conclusions from their study were disappointing. They were unable to find a significant relationship between either slope gradient and each particle size fraction or slope convexity or concavity and the amount of soil or coarse fragment content in any particle size fraction. Second, the amount of soil or coarse fragment content in any particle size class could not be predicted by the amount in the A horizon within any degree of confidence. Thus, in terms of site evaluation for reforestation purposes, each site will need to be field checked in detail for making an accurate assessment of its reforestation potential with respect to the water-holding capacity of the soil and the plantability.

D. M.

# Continuing Education

## BAREROOT NURSERY TECHNOLOGY

October 26-28, 1982. Oregon State University, Corvallis. Program will address forest tree nursery development, seedling growth as related to soil-water-plant management, harvesting and planting and bareroot seedling, operational planning, computerized record-keeping systems, quality control and research needs. CONTACT: Conference Assistant, School of Forestry, Oregon State University, Corvallis, OR 97331, (503)754-2004.

## SOUTHWEST OREGON FOREST WEED ECOLOGY

November 9, 1982. Adaptive FIR, Best Western Riverside Conference Center, Grants Pass, Oregon. This one-day workshop will cover the operational environment, the competitive ecology of grass and woody shrubs, the prediction and assessment of weed competition, and control measures. This workshop is designed to provide a fundamental understanding of southwest Oregon forest weeds. Fee is $10. Limited enrollment. CONTACT: Elaine Morse, Adaptive FIR.

## PULP CHIP QUALITY

November 11-12, 1982. Oregon State University, Corvallis. The course is designed to assist those people who share the responsibility of furnishing chips

for pulp mills understand some of the basic principles of pulping and papermaking, and how these principles relate to chip quality. It would be of interest to foresters, loggers, and in general to anyone associated with chip procurement who is not directly connected with a pulp mill. CONTACT: Conference Assistant, School of Forestry, Oregon State University, Corvallis, OR 97331, (503)754-2004.

ARE LOG EXPORTS THE PROBLEM?

November 12, 1982. Marriott Hotel, Portland, OR; sponsored by the League of Women Voters of Oregon Education Fund. Major topics include the economic impacts of log and wood products exports on employment, domestic wood prices, international trade balance, etc.; state and federal legal restrictions and requirements of log and wood products exports; environmental impacts of log and wood products exports on sustained yield of natural resources, etc.; and the prospects for increasing the export of log and wood products. CONTACT: League of Women Voters of Oregon, 317 Court Street N.E., Suite 202, Salem, OR 97301, (503)581-5722.

73RD WESTERN FORESTRY CONFERENCE

November 30-December 2, 1982. Portland Hilton Hotel. Annual Western Forestry and Conservation Association Meeting. The theme of this year's meeting is "Forestry Dollars and Sense - Gearing Up for the Future." Includes technical sessions on reforestation, stand management, pest management, and fire. CONTACT: Steele Barnett, Western Forestry and Conservation Association, American Bank Building, Portland, OR 97205, (503)226-4562.

STAND MANAGEMENT: FERTILITY

December 14-16, 1982. Oregon State University, Corvallis. This 2 1/2 day workshop is aimed at forest managers who are interested in maintaining forest productivity in the Pacific Northwest. Program will address several aspects of nutrient-conservation and management including: nutrient cycling, nutrient conservation in harvesting, and enhancement of productivity by artificial fertilizers and biological nitrogen-fixation. Program includes exercises in which participants will learn how to plan for long-term nutrient management. CONTACT: Conference Assistant, School of Forestry, Oregon State University, Corvallis, OR 97331, (503)754-2004.

DESIGNATED SKIDTRAILS TO REDUCE SOIL COMPACTION

January or February 1983. Medford, OR. Sponsored by OSU Forest Engineering Extension and Jackson County Extension. A one-day classroom and field workshop is being planned to discuss skidtrail layout with sale layout foresters, timber sale administrators, and loggers. Workshop includes presentations on soil compaction and principles of skidtrail layout. Field portion includes marking of skid trails with a critique to follow. Fee is $55. CONTACT: Conference Assistant, School of Forestry, Oregon State University, Corvallis,

FOOTHILLS FOR FOOD AND FOREST

April 25-28, 1983. Oregon State University, Corvallis. International symposium sponsored by the OSU Schools of Agriculture and Forestry. Hill lands perhaps offer the greatest potential for increased food and fiber supply and the livestock industry is a major factor in their development. This symposium will attempt to explore current development and possibilities for the future of these lands in grazing, and in the grazing/forestry interface for producing food and fiber. Program includes variety of topics related to nutrient management, prospects for growing trees and livestock together, wildlife interaction with domestic animals and forestry, and integrated forage/livestock production. CONTACT: Dr. Jim Oldfield, Department of Animal Science, Oregon State University, Corvallis, OR 97331, (503)754-3431.

YOUNG STAND MANAGEMENT IN SOUTHWEST OREGON

June 14-16, 1983. Adaptive FIR, Holiday Inn, Medford, OR. Program is in the preliminary planning stages. Topics will address management practices which affect young stand growth, as well as how young stand management decisions may affect future management alternatives. CONTACT: Steve Tesch, Adaptive FIR.

# Of Interest

REFORESTATION OF SKELETAL SOILS PROCEEDINGS AVAILABLE

Proceedings of the Reforestation of Skeletal Soils Workshop held in Medford, November 17-19, 1981, are now available for purchase at $7.50 a copy. The proceedings contain 19 papers that address various aspects of the reforestation of skeletal soils with particular emphasis on southwest Oregon. Topics range from "The nature of skeletal soils in steep terrain" to "Site preparation strategies for skeletal soils" and "Mycorrhizal inoculation." Checks or purchase orders should be made payable to: OSU SCHOOL OF FORESTRY, for $7.50 per copy (US dollars) and sent to:

Workshop Proceedings
FIR
1301 Maple Grove Drive
Medford, OR 97501

RESIDUAL STAND DAMAGE AFTER CABLE THINNING

Mike Caccavano, Forest Engineering Department, OSU, recently completed a Master of Forestry paper entitled Factors Influencing Residual Stand Damage Levels Due to Cable Thinning of Coniferous Stands in Western Oregon. The purpose of the study was to determine the significant variables influencing total scar area per acre ($ft^2$/acre) following skyline thinning of coniferous stands. He measured damage levels in ten study areas that had received their first commercial thinning as part of the smallwood harvesting research program. Some units had been logged conventionally, some used prebunching and swinging to the landing. A variety of small to medium-sized yarders were used.

Ten independent variables were measured in three categories: harvesting systems, stand conditions, and topography. A regression equation was produced with three significant variables. These variables include the percent of western hemlock in the stand, the volume removed per acre ($ft^3$/acre) and whether the unit had been logged conventionally or by prebunching and swinging. Damage levels ranged from 0.4 to 64.4 square feet of scar area per acre, with individual scars observed as large as 12 square feet.

The percent of western hemlock in a stand may not be a real useful variable for much of southwest Oregon, but Caccavano also noted that the percent of true firs in a stand also increased damage considerably. Not only do true firs damage more easily than Douglas-fir, but the acceptability of any damage to true fir must be considered in light of its susceptibility to rot.

The mean total scar area per acre was 17.94 square feet with a 95 percent confidence interval from 15.00 to 20.87 square feet. A 10 percent increase above the mean level in percent western hemlock resulted in a 36.7 percent increase in scar area per acre; a 100 $ft^3$/acre increase in volume removed resulted in a 12.3 percent increase in scar area; and prebunching resulted in a 43.7 percent reduction in scar area. Mike indicated that even though prebunching has considerable statistical significance, he doesn't have a good explanation for the strength of the relationship.

It is probably reasonable to conclude, however, that in stands where species sensitive to damage will constitute a large proportion of the residual stand, consideration of specialized harvesting systems, such as prebunching and swinging, may be warranted to minimize damage and decay. Other observations which did not enter into the regression equation, but bear consideration, include: 1) as residual stand density increases, stand damage increases; 2) larger yarders with greater horsepower cause more damage; 3) crew skill is very important (damage can be reduced by careful choker setting).

On the other hand, if the equation doesn't provide some measure of how the scar area is distributed throughout the stand, one doesn't know if only a few trees are badly scarred or if many trees have small scars. A few badly scarred trees may be sacrificed, but having many scarred residual trees in a rot sensitive situation may be unacceptable.

S. T.

## WATERSHED INFORMATION AVAILABLE

The National Forest System, as part of its Washington office watershed staff, maintains a Watershed Systems Development Group (WSDG) at its Fort Collins Computer Center (FCCC). The long-range mission of the WSDG is to provide procedural guides and analytical tools that will help integrate Forest Service watershed management programs into the Resource Protection Act process.

The WSDG has three specific objectives: 1) develop, modify, and support procedural guides and analytical tools that enhance the capacity of watershed specialists to respond to management needs; 2) provide soil, hydrology and water quality technical support of Forest, Regional and Washington office watershed personnel; and 3) provide training to watershed specialists as appropriate.

The main method used by WSDG to communicate its findings to watershed and other interested specialists is a series of WSDG reports. These reports may concern specific subject areas or explain specific procedures or concepts that can be solved with handheld calculators or by computer programs maintained at the FCCC. Examples of their reports include: Statistical Methods Commonly Used on Water Quality Data Analysis; Water Quality Monitoring Programs; Soil Depth Corrections Based on Slope Gradient; Topographic Factor for Universal and Modified Soil Loss Equations; and Statistical Analysis Using SPSS at the USDA Fort Collins Computer Center. These and other reports are available to all interested users from the WSDG upon request.

The WSDG can be reached as follows:

Watershed Systems Development Group
USDA Forest Service
3825 East Mulberry Street
Fort Collins, CO 80524

Telephone: (303)482-0356 - Commercial
323-1417 - FTS

## FREQUENT MONITORING REQUIRED TO INSURE PLANTATION SURVIVAL

In the fall of 1979, studies were established to determine the causes of repeated plantation failure in the red fir zone at Butte Mountain on the Klamath National Forest's Goosenest District. This research was conducted as a result of a cooperative agreement between the University of California, Davis, and Region 5 of the USFS. Work was conducted on two sites: a *Ribes cereum* brushfield, having a southern aspect and a 0-15 percent slope, and an induced meadow dominated by *Bromus marginatus*, with a southeast aspect and 0-15 percent slope. Each had been clearcut 15 years previously.

Three site preparation methods (hand scalping, disk/brushrake and glyphosate [Roundup] treatments) were compared to unmanipulated controls on each site. Comparisons were made in terms of type and presence of competing vegetation, soil moisture at four depths and presence and activity of herbivorous insects and vertebrates.

Red fir, white fir and lodgepole pine seedlings (2-0 stock) planted in May 1980 experienced high rates of mortality, regardless of site or treatment. Over two growing seasons, mortality on some treatments approached 100 percent. Survival was better on treatments where accessible soil moisture was maintained through effective control of competitive vegetation. In addition, vegetation control had to eliminate habitat favorable to herbivorous species present on a site. Treatment which did not sufficiently increase available soil moisture and reduce herbivores were insufficient to significantly alter levels of seedling mortality over the two seasons of this study.

Glyphosate and hand-scalping treatments were moderately successful on the brushfield site in 1980 (Table 1). Defoliation or removal of shrubs freed soil moisture reserves for use by planted conifers. This

advantage was lost during the 1981 season, however, as annual and biennial successional species became established and pre-empted available soil moisture. Standing brush which remained on both treatments provided cover for rabbits, whose feeding activity causes substantial amounts of conifer damage and subsequent death. Survival was best on disking/brushrake treatments over the two-season period. Complete removal of shrub cover prevented soil moisture losses through transpiration and eliminated rabbit habitat. Conifers were able to become established during the first season under optimal conditions of soil moisture and without stress created by rabbit clipping damage. Although annuals had reinvaded the site by the second year, surviving trees were established and appear to have captured the site.

Table 1. Percent conifer mortality following four different site preparation treatments.

| Treatment | Brushfield 1980 | Brushfield 1981 | Meadow 1980 | Meadow 1981 |
|---|---|---|---|---|
| Control (no manipulation) | 58 | 100 | 87 | 95 |
| Disk/brushrake | 24 | 50 | 46 | 100 |
| Glyphosate | 38 | 83 | 34 | 89 |
| Hand-scalped | 39 | 90 | 61 | 100 |

Low soil moisture due to grass competition and the feeding activity of a heavy grasshopper infestation (6-8/m$^2$) were primary mortality sources on the meadow site. Again, treatments which reduced vegetation competition and altered habitat (by reduction of grass cover) provided the best survival during the first year. Glyphosate and disked treatments were most successful here (Table 1). Re-establishment of grasses on disked treatments during 1981, however, reduced soil moisture and increased grasshopper presence and feeding, thus reducing conifer survival to less than one percent. Glyphosate treatments maintained high soil moisture levels through both seasons. In spite of this, mortality increased substantially during the second year. Reasons for this are unclear. The level of grasshopper damage received in 1980, while not sufficient to kill trees that year, may have stressed trees sufficiently to cause mortality in 1981. In the case of fir species, inadequate shading in the open meadow could induce seedling mortality.

Sites such as these, plagued with numerous limitations to regeneration require supervision beyond the first year. Site quality can change dramatically with the appearance of seemingly insignificant amounts of vegetative regrowth. Seedling survival depends on continued monitoring of the site and the ability to react with further control measures when the need arises.

Deborah Orcutt
Department of Botany
University of California, Davis

## THE LOG DRIVE

### Cable Yarding Production Equations

Richard Aubuchon, recently a Master of Forestry student in the Forest Engineering Department of Oregon State University, has completed his Master of Forestry Paper, A Compendium of Cable Yarding Production Equations. A set of tables containing production data, production equations, equipment information, crew information and physical characteristics of the study areas is presented for small (mainline pulls less than 25,000 pounds), medium (mainline pulls between 25,000 and 71,000 pounds) and large (mainline pulls greater than 71,000 pounds) yarders. An excellent discussion on the use of production equations as predictive tools is included. Richard's paper is available either in the library of the Forest Research Laboratory at OSU or from WESTFORNET.

### Log Weights

Accurately estimating log weights is essential for determining the feasibility of cable and aerial logging systems and establishing log bucking guidelines. Often, however, the weight of logs is not accurately known. Ten pounds per board foot is frequently used for determining log weights, but that weight applies only for small timber in thinnings. Seven to eight pounds per board foot is more typical for larger timber. Because the number of board feet within a log will vary with different scale rules, the cubic foot measure provides the most reliable estimate for log volume. The Smalian Formula, which averages the square feet of area inside bark for both ends of a log and multiplies the average end area by the log length, in feet, is a convenient method of obtaining the cubic foot volume of a log. One helicopter logging company uses an average wood density of 48 pounds per cubic foot in southwest Oregon. A sample of 18 logs used to determine log weights for the multispan study described in the Current Research section of this FIR REPORT found an average wood density of 46 pounds per cubic foot. Unless site-specific information is available, an average wood density of 48 pounds per cubic foot applied to the Smalian cubic foot log volume would probably provide a good estimate of log weights in southwest Oregon.

### Safety Publications

The Worker's Compensation Board of British Columbia, Canada, has published a number of excellent handbooks on logging safety. One handbook, the Yarding and Loading Handbook, July 1981, may give an example of the type of information contained in other publications. The Yarding and Loading Handbook contains sections on developing a highlead yarding and loading side, major hazards encountered during highlead yarding and loading, precautions to avoid accidents, clothing and personal protective equipment, use of tools and equipment, and appendices covering first aid, a glossary, and highlead yarding and loading signals. The handbook is well-written and contains excellent sketches depicting the concept being discussed. A complete list of publications and cost of each is available from:

Worker's Compensation Board of British Columbia
5255 Heather Street
Vancouver, B.C. V5Z 3L8
(604)266-0211

D. L.

## DON'T FORGET THE FORESTRY MEDIA CENTER!

The Forestry Media Center at the OSU School of Forestry has a variety of slide-tapes and films available for rent or purchase. Programs are available addressing both broad and very specific topics within the scope of forest management, forest engineering, and forest products. Some recent titles include: Reducing Injuries to Residual Trees During Stand Management Entries, Skylines of the Northwest, Estimating Buffer Strip Survival, Forest Practices and Mass Soil Movement, and Color Infrared Aerial Photography. For a complete list of available media materials contact the Forestry Media Center, School of Forestry, Oregon State University, Corvallis, Oregon 97331 (503)754-4702.

S. T.

## ROSEBURG BLM GRASS CONTROL STUDY

Second-year seedling survival rates for a BLM grass control study designed by Adaptive FIR and conducted by the Roseburg District, are now available. The original study design, 1980 survival percentages and treatment costs have been previously reported (FIR REPORT 3(2):6-7). The study objective was to evaluate the impact of four grass control treatments and an untreated control on Dougas-fir, ponderosa pine, and grand fir seedlings. During the spring of 1981, however, Roundup was applied to one-half of the 1980 Atrazine plots and one-half of the 1980 Atrazine plus Dowpon plots. One-half of the paper mulch plots were also remulched.

Survival patterns established in 1980 continued through 1981. Very poor seedling survival was associated with hand scalping or no grass control treatments regardless of species (Table 1).

Table 1. Percent second-year seedling survival (October 1981) by treatment, stocktype, and species.

| | Stocktype/species | | | | |
|---|---|---|---|---|---|
| Treatment | 2-0 DF (Nursery A) | 2-0 DF (Nursery B) | 1-0 DF | 2-0 PP | 1-0 GF |
| Atrazine 1980 | 71 | 58 | 42 | 93 | 62 |
| Atrazine 1980 Roundup 1981 | 80 | 80 | 75 | 91 | 45 |
| Atrazine + Dowpon 1980 | 71 | 59 | 21 | 93 | 68 |
| Atrazine + Dowpon 1980 - Roundup 1981 | 84 | 73 | 36 | 86 | 70 |
| Paper mulch 1980 | 78 | 76 | 18 | 98 | 38 |
| Paper mulch 1980 + 1981 | 84 | 93 | 45 | 98 | 51 |
| Hand scalp 1980 | 1 | 0 | 0 | 12 | 0 |
| Untreated control | 2 | 0 | 0 | 22 | 0 |

2-0 DF = 2-0 Bareroot Douglas-fir; 1-0 DF = 1-0 Douglas-fir plug; 2-0 PP = 2-0 Bareroot ponderosa pine; 1-0 GF = grand fir plug

The obvious conclusion that can be drawn from these results is that chemical or paper mulch grass control methods are far superior to the alternatives tested in this study. Although the paper mulch treatment may have been very effective, use of the technique is very expensive (FIR REPORT 3(2):6-7) and is subject to terrain limitations such as steep slopes where anchoring of the paper may be difficult and more frequent maintenance necessary. Clearly, chemical control of competing grasses is the most desirable treatment.

S. H.

## ALTERNATIVE SOIL SAMPLES?

At a recent meeting on predicting Douglas-fir response to fertilizer, participants reported some unusual types of tools used to sample surface soils (0-30 cm). They include a garden bulb planter (0-15 cm) and thin-walled electrical conduit (0-30 cm, depending on soil moisture texture). Both of these tools are volumetric samplers which are necessary when the individual samples are to be bulked, mixed, and a single composite sample saved. Thus, they represent an improvement over using shovels for sampling and may consistently produce more representative samples than soil tubes or augers.

These soil samplers also have some unusual features which make them useful in sampling forest soils. The serated edge of the bulb planter helps to cut fine roots and allow easier penetration of the soil. A 2-foot piece of 2-inch conduit (approximately $2), a half-round file and a hammer makes a more sturdy sampling set. The outside of the tube is beveled and the inside edge smoothed. The file is also used to smooth dents in the edge after rocks are encountered. Although the conduit folds under the blows of the hammer, it will withstand heavy use. The replacement cost make it an inexpensive sampler.

D. M.

# Recent Publications

(1) Publications
Pacific Northwest Forest and Range Experiment Station
809 NE 6th Avenue
Portland, OR 97232

(2) Publications
Pacific Southwest Forest and Range Experiment Station
P.O. Box 245
Berkeley, CA 94701

(3) Dr. S. G. Conard
Forestry Sciences Laboratory
3200 Jefferson Way
Corvallis, OR 97331

(4) USDA Forest Service
Equipment Development Center
Fort Missoula
Missoula, MT 59801

(5) FERIC
201-2112 West Broadway
Vancouver, B.C.
Canada V6K 2C8

PHOTO SERIES FOR QUANTIFYING NATURAL FOREST RESIDUES: SOUTHERN CASCADES, NORTHERN SIERRA NEVADA, by K. S. Blonski and J. L. Schramel. 1981. USDA Forest Service Gen. Tech. Rep. PSW-56. Pacific Southwest Forest and

Range Experiment Station, Berkeley, CA. 145 p. A total of 56 photographs show different levels of natural fuel loadings for selected size classes in seven forest types. Data provided with each photo include fuel and stand descriptions.

(2)

LOGGING ROAD CONSTRUCTION IN ROCK: SUMMARY OF THREE CASE STUDIES, by R. K. Krag. 1981. Forest Engineering Research Institute of Canada (FERIC) Technical Note TN-50. Production data is given for three case studies of road construction in rock. Techniques for logging the right-of-way timber volume, removing the overburden, blasting and removing the blasted rock are discussed in detail. Drilling techniques are discussed and production data presented for tank drills and an airtrack drill. Blasting techniques are elaborated upon and examples of charges, patterns, and timing are given for various rock and slope conditions. Information is given on the use of a hammer seismograph and on difficulties encountered with the device. The publication can serve as a source of information for anyone wanting to learn about road construction techniques in rock.

(5)

POISON OAK AND POISON IVY DERMATITIS. PREVENTION AND TREATMENT IN FOREST SERVICE WORK, by W. L. Epstein and V. S. Byers. 1981. USDA Forest Service, Equipment Development Center, Missoula, MT. This report describes a method for identifying the most sensitive workers to keep them away from poison oak/ivy areas and details information about the disease: how it is spread, best treatment methods, how it afflicts people, and how it can be prevented. Extensive information is presented for treating the dermatitis in the field or clinic with topical or systemic (both oral and injected) corticosteriods.

(4)

GROWTH RESPONSES OF WHITE FIR TO DECREASED SHADING AND ROOT COMPETITION BY MONTANE CHAPARRAL SHRUBS, by S. G. Conard and S. R. RADOSEVICH. 1982. Forest Science 28:309-320. Moisture availability was the primary factor that limited growth of white fir within sclerophyll brush on two sites in the northern Sierra Nevada Mountains. The white fir saplings ranged up to 1.5 meters in height and from 300 to 800 trees per ha across the two sites. The chaparral species--greenleaf manzanita, snowbrush ceanothus, and bush chinkapin--covered 80 to 90 percent of the sites and ranged in height from 0.8 to 2.0 meters. Four years after treatment, white fir growth on one site increased to 140 to 160 percent over controls when soil moisture was increased by decreasing brush cover more than 80 percent by cutting and removing the brush tops and spraying the cut stumps with 2,4-D amine. With the addition of the cut tops to provide standing dead shade, growth of white fir on both sites increased to 200 percent, with the additional increase probably being caused by a reduction in water demand by shading. Cutting and removing the brush tops, or reducing brush canopy coverage with glyphosate, yielded slightly lower soil water tensions than for the control plots but did not cause significant changes in white fir growth. These two treatments each were associated with both slight increases and decreases of growth across the two study areas.

This study indicated that treatments which can reduce the brush canopy by 80 percent, control resprouting of the brush and not harm the white fir should yield strong increases in the growth of suppressed white fir.

(3)

POST FIRE SUCCESS IN WHITE FIR (ABIES CONCOLOR) VEGETATION OF THE NORTHERN SIERRA NEVADA, by S. G. Conard and S. R. Radosevich. 1982. Madrono 29:42-56. Observations of post-fire seral changes in the structure and composition of communities ranging in age from 5 to 270 years, and composed of *Abies concolor* and associated species revealed a slow change in dominance from montane chapparel to *Abies concolor*. Two species groups were detected by association analysis. One, containing *Abies concolor* and three brush species characterized early stages of succession. The other group, primarily herbaceous and sub-shrub parasites, characterized mature *A. concolor* forests. Regeneration of shrub species was episodic, occurring only after fire or other disturbance. Reproduction of *Abies concolor* was, however, continuous throughout the succession.

Tree density decreased with time as basal area approached a maximum of 100 to 135 $m^2$/ha following a negative log relationship.

(3)

INFLUENCE OF FOREST AND RANGELAND MANAGEMENT ON ANADROMOUS FISH HABITAT IN WESTERN NORTH AMERICA. 6 SILVICULTURAL TREATMENTS, by F. N. Everest and R. D. Harr. 1982. USDA Forest Service, Gen. Tech. Rep. PNW-134. Pacific Northwest Forest and Range Experiment Station, Portland, OR. 19 p. Distribution of anadromous salmonids and coniferous forest coincides along much of the Pacific slope; consequently, the habitat of anadromous fish is subject to a wide variety of silvicultural treatments required to establish and nuture young forests. Silvicultural treatments discussed in this report include cutting prescriptions, broadcast burning, mechanical site preparation, planting, and competition reduction. Timber harvest and use of pesticides and fertilizers are not discussed. Broadcast burning and machine scarification and piling can increase sedimentation and thermal heating of streams and have the potential to damage habitat of anadromous fish. Habitat damage usually does not occur, however, because of the limited extent of treatments. The highest risk of habitat damage from silvicultural activities occurs in small streams in areas with erosive soils and high rainfall, or with high summer solar radiation and low streamflow. Silvicultural activities discussed in this paper affect fish habitat far less than timber harvest or road construction activities.

(1)

SOIL COMPACTION FROM LOGGING WITH A LOW-GROUND PRESSURE SKIDDER IN THE OREGON COAST RANGE, by R. C. Sidle and D.

M. Orlica. 1981. Soil Sci. Soc. Am. J. 45:1219-1224. Increased bulk density of a clay loam soil on logging skid trails in the Oregon Coast Range was most highly correlated with the logarithm of the number of turns with a low-ground pressure (FMC) skidder. The surface 15 cm of soil was compacted more by uphill than by downhill yarding. After nine turns with an FMC skidder, soil bulk density at the 7.5 cm depth increased approximately 25 and 45 percent for uphill and downhill yarding, respectively. After approximately 18 turns, the predicted bulk density increase of the 22.5 cm soil depth was 25 percent. A modified 10-blow Proctor test slightly overestimated increases in soil bulk density on high-use downhill skid trails. The 15- and 10-blow Proctor tests very closely estimated the density increases for the 7.5 and 15 cm depths for uphill skidding.

1

DUFF REDUCTION CAUSED BY PRESCRIBED FIRE ON AREAS LOGGED TO DIFFERENT MANAGEMENT INTENSITIES, by S. N. Little, F. R. Ward, and D. V. Sandberg. 1982. USDA Forest Service Res. Note PNW-397. Pacific Northwest Forest and Range Experiment Station, Portland, OR. 8 p. A pilot study investigated the impact of two harvesting intensities on duff consumption from prescribed fire. Two units of old-growth Douglas-fir and western hemlock, located in the Willamette National Forest were harvested in 1980 and burned in 1981. Duff consumption was 36 percent less on the unit logged to minimum merchantability specification of 6 inches by 6 feet than on the unit logged to the standard minimum specification of 8 inches by 10 feet. Mineral soil exposure attributed to burning was similar and below regional guidelines for both units.

1

WATERSHED CLASSIFICATION BASED ON SOIL STABILITY CRITERIA, by D. N. Swanston. 1981. In: D. M. Baumgartner (ed.). Interior West Watershed Management Symposium. Extension Service, Washington State University, Pullman. Judging the natural stability of a watershed and assessing soil mass movement hazards related to harvest activities is possible by combining subjective evaluation of factors controlling stability of an area and a limited strength-stress analysis based on available or easily generated field data. The resulting analysis indexes the watershed in terms of relative hazard, identifies problem areas, defines failure mechanisms, and pin-points factors which may be amenable to specific control or correction procedures.

1

INTERACTION AMONG WEEDS, OTHER PESTS, AND CONIFERS IN FOREST REGENERATION, by S. R. Radosevich and S. G. Conard. 1982. In Biometeorology in Integrated Pest Management. p. 463-486. Academic Press Inc. Foresters and other resource specialists interested in brush control will find this publication to be very useful. It is a clearly written synopsis of the competitive autecology of western conifer and brush species regarding water and light. The authors also briefly discuss the roles of vegetation with respect to conifer depredation by insects and small mammals. Unfortunately, there is no discussion of grass-conifer competition, nor of the roles of allelopathy and competition for nutrients. With 41 references.

3

STREAMFLOW CHANGES AFTER LOGGING 130-YEAR-OLD DOUGLAS-FIR IN TWO SMALL WATERSHEDS, by R. D. Harr, A. Levno, and R. Mersereau. 1982. Water Resources Res. 18:637-655. Harvesting 130-year-old timber in two small watersheds in the H. J. Andrews Experimental Forest in the central, Western Oregon Cascades increased annual water yield up to 42 cm. For 4 years after logging, yield increases averaged 38 cm at a 13.0 ha clearcut watershed and 20 cm at a 15.4 ha watershed where timber was shelterwood cut. Increased summer flows were indicated by much fewer low-flow days after logging, particularly at the clearcut watershed. Neither the size nor the timing of peak flows changed significantly after logging at either watershed.

1



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# FIR Report

## WINTER 1983

VOL. 4 NO. 4

"FIR REPORT" is a quarterly publication containing information of interest to individuals concerned with forest management in southwest Oregon. It is mailed free on request. Requests should be sent to: FIR REPORT, 1301 Maple Grove Drive, Medford, Oregon 97501.

FIR REPORT communicates recent technological advances and research pertinent to southwest Oregon, and alerts area natural resource specialists to upcoming educational events. Comments and suggestions concerning the content of "FIR REPORT" are welcome and should be sent to the Maple Grove address.

The Southwest Oregon Forestry Intensified Research Program (FIR) is a joint effort between the School of Forestry at Oregon State University and the Pacific Northwest Forest and Range Experiment Station of the U.S.D.A. Forest Service. It is designed to assist region foresters and other specialists in solving complex biological and management problems unique to southwest Oregon. FIR specialists organize, coordinate, and conduct educational programs and research projects specifically tailored to meet regional needs.

Established in October, 1978, the FIR Program is supported by Oregon State University, the Bureau of Land Management, U.S.D.A. Forest Service, O & C Counties, and southwest Oregon timber industries. It represents a determined effort by the southwest Oregon forestry community and county governments to find practical solutions to important forest management problems.

For the FIR Staff

Steven D. Tesch
Silviculture Specialist

## Inside



OREGON STATE UNIVERSITY EXTENSION SERVICE

## FORESTRY INTENSIFIED RESEARCH

SERVING SOUTHWEST OREGON THROUGH RESEARCH AND EDUCATION

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# Current Research

# Adaptive FIR

## EFFECT OF RIPPING ON PONDEROSA PINE SEEDLINGS

In the last issue of the FIR REPORT [4(3):3-4], I reported first-year results of a study designed to evaluate the effects of soil ripping on ponderosa pine seedling survival and growth. The study site is located in southwestern Jackson County just outside of Ruch at an elevation of 610 m on a 30 percent south slope. The soil is of the Vannoy series and is classified as a fine-loamy, mixed, mesic Typic Haploxeralf. Originally dominated by several manzanita species, the study area was site prepared as previously described [FIR REPORT 4(3):3-4]. Soil ripping was accomplished with a D-4 tractor to an approximate soil depth of 30 cm. One hundred sixty 2-0 bareroot and 160 1-0 bareroot ponderosa pine seedlings were shovel planted in the spring of 1981. One-half of the seedlings in each stocktype were planted in the rips while the other half were planted mid-way between rips. Second-year results of the study are now available.

Survival of the two stocktypes continues to remain very high two years after planting with no significant differences in survival due to soil ripping (Table 1). Despite the lack of treatment effects, the rate of seedling survival is encouraging given the droughty nature of the site.

Table 1. Percent survival of 1-0 and 2-0 bareroot ponderosa pine seedlings in ripped and unripped planting spots.

| Stocktype/ treatment | | Seedling Survival (%), by year 1981 | 1982 |
|---|---|---|---|
| 1-0: | ripped | 99 | 98 |
| | unripped | 100 | 100 |
| 2-0: | ripped | 98 | 96 |
| | unripped | 99 | 99 |

Height growth dramatically increased for both stocktypes during the 1982 growing season (Table 2). Soil ripping did not, however, affect the magnitude of these increases. It is likely that differences in growth between 1981 and 1982 reflect recovery from planting shock and more moderate weather conditions during the summer of 1982.

Table 2. Mean height growth (± s.d.) of 1-0 and 2-0 bareroot ponderosa pine seedlings in ripped and unripped planting spots.

| Stocktype/ treatment | | Initial height (cm)[1] | 1981 growth (cm) | 1982 growth (cm) |
|---|---|---|---|---|
| 1-0: | ripped | 7.6 ± 2.3 | 3.9 ± 2.0 | 12.9 ± 5.1 |
| | unripped | 8.1 ± 2.5 | 4.1 ± 1.8 | 13.7 ± 4.6 |
| 2-0: | ripped | 10.7 ± 3.2 | 5.8 ± 9.6 | 13.5 ± 5.2 |
| | unripped | 11.1 ± 3.5 | 5.8 ± 6.9 | 14.4 ± 5.7 |

[1]Differences in initial height between ripped and unripped seedlings reflect soil sloughing into the rip furrow shortly after planting.

The lack of any difference in seedling survival or growth between treatments after two years is sufficient reason to question the need for ripping under the conditions described. The soil could, however, have been ripped to a deeper depth such as 46 cm which might have produced different results. Nonetheless, observations to date have not shown any benefit derived from ripping. Final judgment on this particular ripping technique should be reserved, however, until additional data have been collected.

S.H.

## FIRST SUMMER SURVIVAL FOLLOWING SITE PREPARATION

In August 1981, a study was initiated to evaluate the effectiveness of various machine site preparation techniques in aiding the reforestation of Low Intensity Management lands in the northwest portion of the Grants Pass Resource Area, Medford District, BLM. The site is at 4,000 feet elevation, with southerly slopes and soils weathered from granodiorite. The site was clearcut and site preparation treatments were installed by November 1981.

Snow covered the site from mid-December until May 1981, delaying planting until May 18. The site was planted with 2-0 Douglas-fir. Seedlings were slow to break bud, with some still shedding budcaps in September.

After the first growing season, survival is good for all treatments except the control (Table 1). Although the survival to date is good, the performance of the stock has been generally poor. This conclusion is based on the retarded budbreak, loss of older needles, and short leader growth of the seedlings.

Table 1. Seedling survival after one growing season, by treatment.

| Treatment | Treatment description | Survival |
|---|---|---|
| Control | No site preparation | 54% |
| Scarification | Slash and shrubs removed with slashrake | 92% |
| Scarification + rip | Scarification and soil ripped with rock rippers | 95% |
| Soil removal | Slash, shrubs, and two or more inches of soil removed with a dirt blade | 95% |
| Soil removal + rip | Soil removal and soil ripped | 87% |

Table 1 indicates the relative importance of good site preparation in obtaining seedling survival. However, the high rates of survival may also be a function of late June precipitation in 1982. Precipitation on the site was negligible for the first six weeks after planting and budburst was slow. On June 26 and 28, a total of 1.3 inches of rain fell; thereafter increasing numbers of seedlings began to break bud and initiate leader growth.

During the first winter after logging and site preparation, standing water was observed in depressions on all treatments except the control plots, and small rivulets flowed across some of the plots on several occasions. However, erosion has been negligible. Storm events of 2 to 3 inches of precipitation in 24 hours were responsible for the standing water, but these storms did not approach the intensity expected to occur every couple of years in this area. Therefore, precipitation will continue to be monitored on the site in coming years and erosion pins have been installed to document any future erosion attributable to machine site preparation treatments.

D.M.

## RAVEL DEFLECTION DEVICES

A study to evaluate the effectiveness of ravel deflection devices to prevent seedling burial was installed in an old clearcut in the Glendale Resource Area, Medford District, BLM. Previous reforestation efforts on the site have failed. The brush had recently been treated with herbicide.

Ravel deflection devices evaluated included shingle wedges and 1 x 2 x 18 inch and 1 x 4 x 18 inch stakes placed directly upslope of the seedling. The control was unprotected seedlings. In addition, a flat bench about 8 inches wide was excavated behind half of the seedlings prior to planting. The bench was to protect seedlings by catching ravel before it reached the seedlings.

The site was planted in mid-March and subsequently covered by the April snows. To date, no seedling mortality could be attributed to burial by ravel; however, ravel movement during the summer was minor. One to two percent of the unprotected seedlings were partially buried but not killed by ravel.

Interestingly, the material covering seedlings was not ravel but old logging slash. Ravel deflectors stopped the movement of slash in numerous instances; however, in certain situations slash may be a more serious cause of seedling burial than ravel per se. This is most apt to be the case if the ravel is less than an inch in diameter and the seedlings are of good caliper.

The movement of logging slash and the trailing mass of ravel detained behind it will be greatest during snow-creep on steep slopes. Thus, on higher elevation sites, we are more prone to find seedlings buried than on lower elevation sites where snow packs are intermittent.

D.M.

## PLANTED DOUGLAS-FIR SURVIVES UNDER HARDWOODS

First year survival data indicate that low value hardwood stands in southwest Oregon have a good potential to be converted to more valuable Douglas-fir by herbicide treatment followed by underplanting. Hardwood stands composed of tanoak, madrone, and chinkapin with basal areas of 250 to 350 feet$^2$ per acre were injected with triclopyr amine (Garlon 3A) in September 1981, and planted with 1-0 plugs (10 c.i.) and 2-0 bareroot Douglas-fir seedlings in May 1982. Adjoining untreated areas were similarly planted to serve as controls. The treatments were replicated three times. First year survival and height growth indicate differences between the treated stands and between stocktypes (Table 1).

Table 1. First year (1982) survival and growth - Underplanting study.

| Treatment/stocktype | Survival | Height growth (in.) (unbrowsed seedlings) |
|---|---|---|
| Injected hardwoods | | |
| 1-0 plugs | 95 | 3.8 |
| 2-0 bareroot | 90 | 2.1 |
| Control | | |
| 1-0 plugs | 94 | 3.0 |
| 2-0 bareroot | 66 | 1.1 |

The plugs, which broke bud quickly, survived very well in both treated and control stands. The bareroots, which exhibited delayed bud break, survived well in the treated stands but not in the control areas. Height growth followed similar patterns. Seedling performance therefore appeared to be related to seedling vigor as well as herbicide treatment. Moisture stress measure-

ments during the growing season showed that seedling stress was much greater in the control stand than in the injected hardwoods. Because this year's growth was largely dependent on the seedlings' previous benign nursery environment, growth and survival of seedlings in the treated stands should increase compared to those in the uninjected control stands as the latter cope with diminished photosynthesis caused by lower light levels and greater moisture competition.

O.H.

## BAREROOTS AND PLUGS DO WELL ON TIN PAN PEAK BURN

Bareroot 2-0 and 1-0 plug seedlings of ponderosa pine and Douglas-fir were planted in February 1982 on a low elevation west-facing slope (40%) within the area burned by the Tin Pan Peak fire in 1981. The study included 4 replications of 4 stocktype-species combinations, each planted with 50 seedlings per treatment plot. Personnel from FIR and the Medford BLM removed snags to eliminate shade and then planted the seedlings. Competition from grass and resprouting hardwoods was controlled with herbicides, and baiting proved necessary to control gopher depredation. First year survival indicated the Douglas-fir and pine survived equally well but that survival differed between stocktypes (Table 1).

Table 1. First year survival (%) at Tin Pan Peak.

| Species | Survival (%) 1-0 plugs | 2-0 bareroots |
|---|---|---|
| Douglas-fir | 90 | 99 |
| Ponderosa pine | 92 | 98 |

Budbreak on all species and stocktypes occurred quickly in the spring which indicated good seedling quality. These first-year results are encouraging and, if trends continue, suggest that withdrawn lands similar to the Tin Pan Peak site have a high probability of successful reforestation given good quality seedlings, proper planting, and control of weeds and gophers.

O.H.

## SHADE ALTERNATIVES

Although cheaper than shelterwood systems, providing artificial shade with shadecards to Douglas-fir seedlings planted on open south-facing slopes still costs a lot of money--about $0.40 per seedling--and may not be the most cost-effective way to guarantee acceptable levels of stocking under some conditions. First-year survival results of a shading study carried out on the Medford District, BLM, shed some insight into the conditions when shading may be most effective.

The object of the study was to compare south shadecards (standard placement), east shadecards, and styrofoam coffee cups inverted around the seedling's base with unshaded controls. These four treatments were installed as randomized block experiments at two locations. First-year survival results are presented in Table 1.

The Lick Gulch site is located on a south-facing 30-40% slope at 2900' elevation on withdrawn land. The site was a manzanita brushfield before being cleared and operationally planted in 1981. The area receives about 30 inches of annual precipitation and has a high bulk density clay loam soil. Potential insolation during the growing season (May 1 to September 30) is about 144,000 gram-calories. Application of atrazine eliminated grass competition. Seedlings for the shade study were planted properly in February 1982, and broke bud quickly in the spring.

Table 1. First year (1982) survival for shade treatments.

| Study area | Survival, by treatment (%) No shade | South shade | East shade | Styrofoam cup |
|---|---|---|---|---|
| Lick Gulch (withdrawn land) T.39S, R.2W, S.34 | 95 | 100 | 99 | 99 |
| Julie Creek T.34S, R.9W, S.35 | 59 | 84 | 72 | 75 |

The Julie Creek site is a south-facing clearcut at about 3100'. Old-growth Douglas-fir was harvested and the site burned in 1981. Slopes range from 40 to 60% and the soil is a lower bulk density gravelly loam. The area receives about 80 inches of precipitation annually and potential summer insolation averages about 142,000 gram-calories. In contrast to Lick Gulch, the shade treatments were installed on operationally planted seedlings and planted in May (because of snowed-in roads) during warm weather by an inexperienced crew. These seedlings exhibited delayed bud break.

The most interesting comparison has nothing to do with shading. The high survival of the unshaded controls (95%) on Lick Gulch compared to the lower survival (59%) of controls on the better Julie Creek site strongly suggests that initial survival depends more on proper seedling quality and planting than on land classification of these two sites.

Among the shading treatments, the standard south shadecards consistently gave the greatest increase in survival. The increases vary, however, in importance between the two sites. The 5% increase at Lick Gulch is significant statistically but very likely will not prove to be cost-effective, given the 95% survival of the controls. In comparison, at Julie Creek, the increase in survival from 59% to 84% would easily prove to be cost-effective if the alternative to meet stocking goals such as fill-in planting was more expensive.

The other shade treatments, the east cards and styro-cups, had equal effects on survival. The lower cost of the cups ($0.08 to $0.14 installed) makes them clearly more cost-effective than east shadecards. Their lower cost, despite their lower survival, could also make them more cost-effective than the south shadecards if the survival rate achieved by using the cups met stocking goals.

O.H.

# Fundamental FIR

## PREDICTING TANOAK SPROUT DEVELOPMENT, FROM PARENT STEM DIAMETER, PRIOR TO CUTTING

A master's thesis in silviculture has developed a technique for predicting the potential cover from tanoak stump sprouts. Work was done on 11 sites in the Siskiyou Mountains which had been clearcut and burned one to six years previously. Width, crown area, leaf area and biomass of tanoak sprout clumps one to six years old were all strongly related to parent stump d.b.h. prior to cutting. Correction techniques are provided for multi-stem clumps. Thus, using a stand table with numbers of tanoak stems by diameter class, foresters can predict the potential cover up to six years after cutting. Copies of the thesis, written by Tim Harrington, are available at the FIR office and BLM headquarters in Medford and at the Siskiyou Forest Supervisor's office in Grants Pass. Data has been collected to develop similar prediction techniques for sprouting madrone. This information should be available at the same locations by March 1983.

Please contact me if you have comments or questions about this technique.

John Tappeiner, OSU, Forest Science
(503)754-4215

## SHADING AND MULCHING EFFECTS ON SOIL TEMPERATURE

Early results from the summer 1982 experiments of the Reforestation Microclimate project indicate that there are substantial differences between several shading and mulching treatments in their effect on shallow soil peak temperatures near the stems of Douglas-fir seedlings. The most effective treatments keep the soil close to air temperature while the least effective allow it to warm to higher temperatures than those reached near seedlings with no treatment.

Figure 1 shows maximum temperature at a depth of 2 cm (about 3/4 inch) for each of 16 treatments and 3 controls on one day in late August. The temperatures were measured by thermocouples which were buried at the time of planting within 1.2 inch of the stem of the seedlings on the south side. Care was taken not to distort the soil temperature profile by the presence of the thermocouple. Data for the figure were obtained from observations repeated at approximately 45 minute intervals throughout the day. For most treatments, the number plotted is the average of 5 replications. The exceptions have the actual number of replications indicated in parentheses. The bars show the range of one standard deviation above and below the average.

The treatments fall into three groups as shown in the figure. Standard lath-stake shadecards were oriented in five different directions for the first group. In all cases but one, the back of the card faced the seedlings. In the case of the treatment labeled SW/E-W, the stake was driven to the southwest of the seedling but the card itself faced south. This was tried because previous results had indicated that reflection of sunlight from the back of southwest oriented shadecards in the morning could increase soil tempertures.

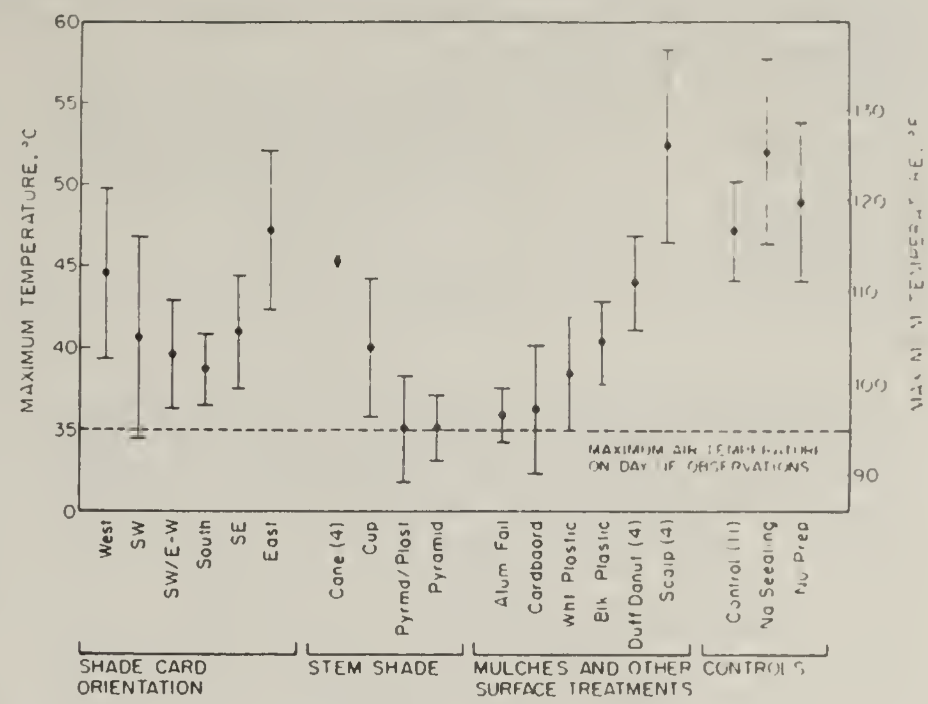


Figure 1. Maximum soil temperatures at 2 cm depth, by treatment, August 24, 1982.

All of the treatments in the stem shade group are experimental (i.e., not currently used operationally). The styrofoam cup is being used in an Adaptive FIR experiment conducted by Helgerson and reported in this issue. An ordinary styrofoam coffee cup with the bottom removed is slit along the side and inverted around the base of the seedling. The other three treatments were developed for this microclimate experiment. The cone is a shaped piece of white file card stapled around the base of the seedling stem to form a cone about 3 inches high with a 2-inch-diameter base. The pyramids are formed from medium weight white cardboard folded to form three sides of a four-sided pyramid about 6 inches high with a 10-inch base. The peak of the pyramid is cut off to provide a hole for the stem and lower branches of the seedlings, and its base is sloped to match the angle of the site (60% south aspect). One of the two groups of pyramids has white plastic stapled to the bottom edge to serve as a mulch. The open side of both pyramids faces north.

The mulches consist of heavy-duty aluminum foil (18-inch squares), heavy waxed cardboards, and white and black polyethylene film (all 30-inch squares). The duff donut is basically a scalp but with some of the removed surface material piled in a one- or two-inch-thick "donut" around the seedling stem. At this particular site there was little real duff, so the donut was mainly of surface soil material.

The control group includes, besides seedlings planted in the normal way with a hoe (but with no treatment applied), two groups where no tree was planted. The first had all the usual preparation operations such as scraping the surface performed, but no tree was actually planted. In the No Prep group, the site was disturbed only to the extent necessary to insert the thermocouple.

Statistical analysis of the data, assuming equal population variances, yields for each treatment a value for the minimum reduction in peak temperature compared to the control seedlings at the 95% confidence level. The following examples illustrate the magnitudes of the statistically significant reductions of peak temperatures. The corresponding numbers for the remaining

treatments exhibit a pattern similar to that shown by the average values in the figure.

| Treatment | Minimum reduction (95% confidence) of peak temperature, °F |
|---|---|
| West shadecard | 0.0 |
| South shadecard | 10.1 |
| All pyramids | 17.6 |
| Black plastic | 7.0 |
| Scalp, | -2.2 |

Since there is evidence that direct heat damage has an exponential dependence on temperature, a few degrees of reduction in maximum soil temperatures could be a distinct survival advantage under conditions where soil tempertures approach the lethal limit. However, treatments also differ considerably in installed cost. This kind of quantitative information on treatment effectiveness (extended to other survival-related variables as well as temperature) can be coupled with site-specific information and regional climatic probabilities to eventually allow more objective and successful balancing of cost and effectiveness when selecting treatments.

A few cautions about interpretation of these results are in order. This is the first look at just a portion of the total summer-long data set; there are many analyses yet to be done and the final results may differ. The data presented represent effects on maximum shallow soil temperature only, and the analysis so far has not considered other possible benefits of the treatments such as reducing length of exposure to high temperatures or increasing moisture availability. The 1982 study included measurements of soil moisture as well as growth and survival data on a much larger sample of each treatment, and these results will be forthcoming.

Ed Miller, OSU, Forest Engineering
Dick Holbo, OSU, Forest Enigineering
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## VEGETATION CLASSIFICATION IN SOUTHWESTERN OREGON - A PRELIMINARY REPORT

How many times have you pondered over questions as you walked through forest stands? For example...Why does this stand seem different from the one upslope? Why is beargrass here and what does it mean? Why isn't western redcedar found on my district or area? What species mix would best regenerate the site? What species is most productive through the rotation?

The list of questions is endless, but an approach to answering them is in preparation. The Pacific Northwest Forest and Range Experiment Station (PNW) and the U.S.D.A. Forest Service's Southwestern Oregon Ecology Program are cooperatively developing a plant association classification for public and private lands in southwestern Oregon. Vegetation classification has been effectively applied in Washington, Oregon and Idaho to answer management's questions and predict vegetation's response to management activities.

Vegetation occurs along complex environmental gradients related to climate, geology and topography. Additional complexity may be added when localized disturbances such as storms, fires, grazing and past-use blur natural patterns. In fact, disturbance has been so much a part of southwestern Oregon's history that it is often difficult to determine the productive capacity or limitations of a site. Vegetation classification can simplify the complexity by using vegetation to indicate the operative environment, site capacity and response to management. Vegetation classes, called Series and Associations, are formed by dividing the vegetation gradient at natural breaks into discrete classes. Each class has its characteristic productivity, response and limitations and can be efficiently managed as a discrete entity.

The Series is the higher level in the classification hierarchy and is named after the climax dominant tree species. Series are used at the planning level; they reflect a broad range of environmental conditions. The association uses subordinate vegetation and site factors for more specific project application.

Several authors have classified parts of southwestern Oregon. Bailey (1966) worked out secondary successional patterns on the southern Oregon Coast, Emmingham (1973) classified the lower Illinois River drainage. But the greatest body of knowledge has come from the many people who have written descriptions of Research Natural Areas. Franklin and Dyrness (1973) summarized their findings and provided a sound basis for further work in the area.

We now have a new and comprehensive data base consisting of over 4,000 ecological plots in southwestern Oregon. This data base and others such as timber inventories, stand exams, soil inventories and special studies are providing a finer resolution of the environment and its associated vegetation.

The following series have been tentatively identified in southwestern Oregon from the samples:

| Common name | Scientific name acronym |
|---|---|
| Mountain hemlock | TSME |
| Pacific silver fir | ABAM |
| Shasta red fir | ABMAS |
| Western white pine | PIMO |
| White fir | ABCO |
| Western hemlock | TSHE |
| Western redcedar | THPL |
| Port-Orford-cedar | CHLA |
| Grand fir | ABGR |
| Tanoak | LIDE3 |
| Douglas-fir | PSME |
| Ponderosa pine | PIPO |
| Oregon white oak | QUGA |
| Lodgepole pine | PICO |
| Jeffrey pine | PIJE |

A brief summary of each series follows:

The mountain hemlock series is the coldest and highest in elevation. It is discontinuously located in cirque topography in the Siskiyous but comprises a zone, or band, in the southern Oregon Cascades. It grades into whitebark pine at higher elevations to the east of the Cascade crest and mixes with the Shasta red fir series at lower elevations and high elevation south slopes to the west.

The Shasta red fir series occupies the next lower elevational band. It is limited in range to southwestern Oregon and northern California and mixes with the Pacific silver fir series at high elevations in the northern half of its range.

The Pacific silver fir series seems to require more summer moisture than the Shasta red fir series, and Englemann spruce is more often associated with Pacific silver fir than Shasta red fir. It is a restricted series within southwestern Oregon, occurring only as far south as the Rogue-Umpqua Divide, with discontinuous patches south into the Rogue National Forest.

The western white pine series is another high elevation series but is a very special case. Western white pine is climax on a few cold, ultrabasic sites in the Siskiyous. Jeffrey pine is a distinctly subordinate associate to western white pine at these high elevation sites.

The white fir series occurs at lower elevations than the Shasta red fir and Pacific silver fir series. It is the most widespread series in southwestern Oregon. There is a substantial amount of vegetational variety in the white fir series and many of our silvicultural problems occur here.

The western hemlock and tanoak series occur below the white fir series. Western hemlock seems to require more moisture than tanoak. It occurs near the coast in association with tanoak and along the western flank of the Cascades, chiefly north of Butte Falls. Tanoak dominates south of Port Orford and slightly farther inland than western hemlock but does not occur in the Cascades. This distribution pattern suggests that western hemlock cannot dominate under conditions of high evapotranspirational demand. (There are significantly more clear, summer days south of Butte Falls and south of Port Orford.) The tanoak series, on the other hand, requires ample soil moisture and can tolerate atmospheric demand but favors sites where temperature extremes are modified by the oceanic influence. Tempertures, both soil and air, are generally warmer in the tanoak series than in the western hemlock series.

The western redcedar, Port-Orford-cedar, and grand fir series occur along drainage bottoms and are usually confined to lower elevations. Although these series are not widespread, they are the most productive in terms of timber and wildlife. Many of our resource conflicts are associated with these series.

The Douglas-fir series does not occur as an elevational band. It occupies sites that are hot and dry over a wide range of elevations. Together with the tanoak and ponderosa pine series, it characterizes the Mixed-Evergreen Zone of the Franklin and Dyrness (1973) classification. The evergreens such as tanoak, canyon live oak, chinkapin and madrone do play an important role in this series. They often dominate the site immediately following fire or disturbance, competing with economically important conifers for light, water and nutrients. Fires are frequent in this series because of its hot and dry environment. The series occurs sporadically in the central Oregon Cascades (Means 1981) and becomes increasingly more common in the southern Cascades. In the Siskiyous, where evapotranspirational demand is high, the Douglas-fir series almost becomes zonal.

The ponderosa pine series is the lowest elevational series that still produces commercial timber. Most sites skirt the valley floor and have been repeatedly disturbed or converted to nonforest uses. A ponderosa site is often dominated by a few old pines with scattered black oak, manzanitas, madrone and a few white oaks.

The Jeffrey pine series and the lodgepole pine series, like the western white pine series, are special cases. Jeffrey pine is almost totally confined to serpentine or peridotite parent materials or soils derived from them. On most, but not all, sites it does not produce commercial timber.

The lodgepole series is confined to high elevation cold pockets with coarse textured soils such as pumice. It is borderline commercial and reforestation is extremely difficult.

The relative elevational position of each series is depicted across a west-east gradient in the southern Coast Range (Figure 1), the Siskiyou Mountains (Figure 2) and the southern Cascade Range (Figure 3).

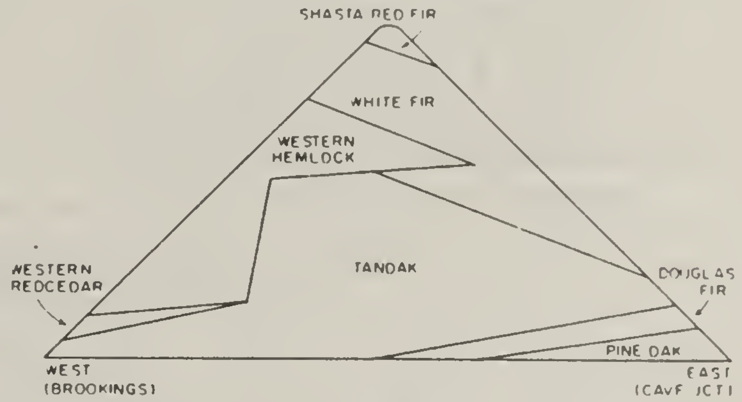


Figure 1. Schematic representation of the relative positions of the series in the SOUTHERN COAST RANGE.

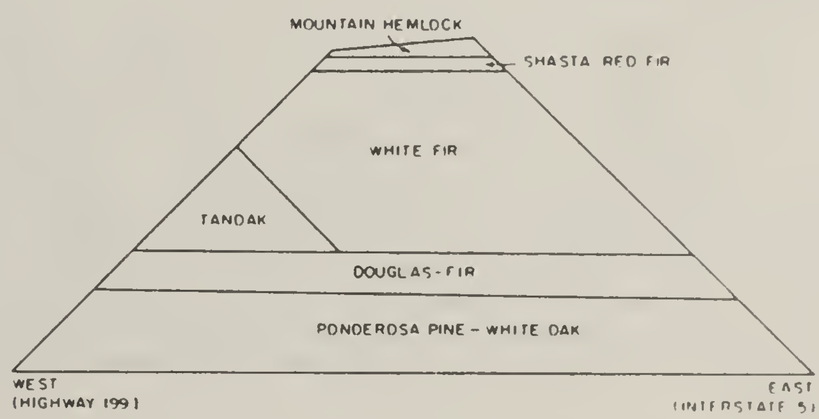


Figure 2. Schematic representation of the relative positions of the series in the SISKIYOU MOUNTAINS.

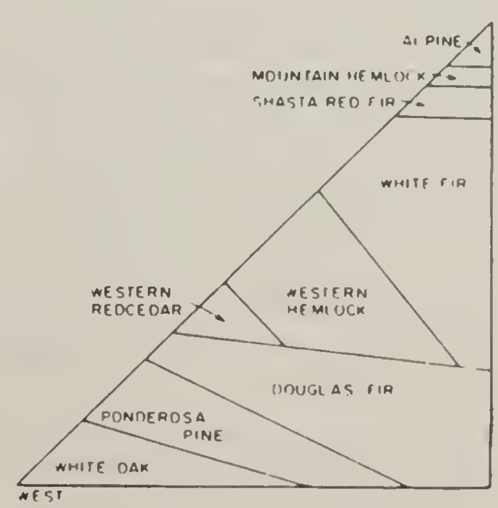


Figure 3. Schematic representation of the relative positions of the series in the SOUTHERN CASCADE MOUNTAINS.

Generally, the series tie together zones of environmental similarity. Understanding the environmental requirements of a series goes a long way toward applying the proper silvicultural prescription. But our project level working units are the plant associations. At this preliminary stage of development we feel that it will require well over 50 plant associations to characterize southwestern Oregon. Within the next few years we will be developing and publishing management guides and other publications that will deal specifically with the plant associations. If you have any questions, please contact one of us through the Siskiyou National Forest.

Tom Atzet, Forest Service
David Wheeler, Forest Service
Jerry Franklin, Forest Service
Brad Smith, Forest Service

## VARIATION IN DATES OF MAXIMUM SOLAR HEATING POTENTIAL WITHIN A MANAGEMENT UNIT

Slope and aspect are recognized as important factors in prescribing silvicultural practices for harvested units. These two site properties are considered along with soil, elevation, and habitat characteristics when planning reforestation activities. It is obvious that substantial variability exists among the slopes and aspects of individual seedling microsites, but units are typically described on the basis of only average slope and aspect. Values are often obtained from a topographic map of the unit, with no information about microsite variability.

Differences in planting spot slope and aspect strongly influence the timing of the solar heat load on seedlings. The microtopography of the planting spot may result in maximum solar heat loads which occur much earlier than June 21, the date most commonly associated with high solar heat loads [FIR REPORT 4(2):5-6]. This variation in heat load probably influences seedling bud burst, growth initiation, dormancy, and ultimately mortality. If microsite slope and aspect are taken into account, silviculturists may be able to better interpret the variation in seedling performance observed on many sites.

This note summarizes the effect of variability in seedling microsite on the timing of maximum solar heating potential, as observed at the Wolf Creek reforestation microclimate site. This clearcut unit is visually quite uniform with an average slope of 60 percent, and an average aspect of 182 degrees. Five hundred 2-0 Douglas-fir seedlings were planted in the spring of 1982. The slope and aspect of each seedling microsite (an 8-inch diameter area around the seedling) was then measured with a specially designed device. The planting operation was found to have reduced the average slope at the seedlings from 60 to 46 percent.

When analyzed using DASUNMX, a program for predicting the dates of maximum heating potential, the dates of maximum solar heating potential differ greatly between 46 percent and 60 percent slopes. Maximum heating potential for a 46 percent slope occurs on May 11 and again on August 1, with maximum heating potential for a 60 percent slope occurring on April 21 and again on August 21. There is a 20 day difference in timing of potential maximum heat load when microsite slope is used in the calculation rather than average unit slope.

When microsite aspect is also considered, the variability among the 500 microsites resulted in an average departure of 35 days from the June 21 maximum, with a standard deviation of 24 days. It is likely that the "average seedling" would receive maximum solar heating on May 18 and again on July 27, but some microsites would experience maximums as early as April 24 and again as late as August 20.

The results emphasize several points. Variability in microsite slope and aspect significantly affect the timing of the potential maximum heat load for seedlings. Broad brush unit averages for slope and aspect may not adequately represent the seedling microsite. As per my earlier FIR REPORT article, be aware that steep slopes with southerly aspects receive maximum potential solar heat loads long before June 21 and again later in the summer.

The 500 microsite sample illustrates that knowledge of microsite slope and aspect improves our estimate of the seedling environment. However, the data also show that lots of variability in microtopography is encountered across the unit which means lots of variability in the timing of potential solar maximums for individual seedlings. The large microsite variability is probably typical of most reforestation units. I propose that stratification of reforestation data by seedling microsite conditions may help explain variability in plant response. The Reforestation Microclimate project would welcome opportunities for collaboration with other projects to jointly exploit this or other developments.

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## GENETICS OF THE DOUGLAS-FIR SHELTERWOOD REGENERATION SYSTEM

Shelterwoods have been an important management tool for regeneration of Douglas-fir throughout southwest Oregon. Shelterwoods are commonly used on sites that are difficult to regenerate following clearcutting (i.e., south- and west-facing slopes) and are most often underplanted. On some sites, however, natural regeneration can be significant. Natural regeneration is desirable because a local seed source is guaranteed. In addition, there is potential for a small amount of genetic gain if the leave trees are superior. However, the question of the genetic makeup of stands regenerated by a small number of leave trees (typically 10-15/acre in southwest Oregon) has not been addressed. In 1980 a study was begun to examine the genetics of two shelterwood stands on the Diamond Lake District, Umpqua National Forest.

Both shelterwoods were fully stocked with 3-5 year old natural regeneration and were adjacent to uncut stands of Douglas-fir. Allozyme markers (variants of single genes) were used to determine the genetic composition of trees in the uncut stands, leave trees in the shelterwoods, and natural regeneration in the shelterwoods. Preliminary results indicate that the genetic makeup of the shelterwood leave trees and their progeny (natural regeneration) is not appreciably different from that of the adjacent uncut stands. For example, genetic variability as measured by the mean number of variants per gene (based on 10 genes) did not differ significantly among the sampled populations. The mean for the uncut stands was 2.85, for the leave trees 2.95, and 2.90 for the natural regeneration.

In addition, it has been suggested that wide spacing in shelterwoods may lead to reduced cross-pollination among leave trees and increased proportions

of self-fertilized (i.e., heavily inbred) progeny. The mean estimate of selfed seeds from trees in the uncut stands was 2.5% and was 6% in the shelterwoods. Thus, the percentage of selfed seeds was more than doubled in the shelterwood stands, but we have yet to determine what proportion of the selfs actually survive to the seedling stage. On the whole, the shelterwood regeneration system appears to have had only a very limited impact on the genetic composition of the regeneration in these stands.

David Neale, OSU, Forest Science
Tom Adams, OSU, Forest Science

## FIR GROWTH AND YIELD PROJECT - INTERIM STATUS REPORT

The FIR Growth and Yield Project has now completed two summers of data collection. Sampling in 1981 and 1982 covered the mixed-conifer forests along the western slope of the Cascades from the Dead Indian Highway north to the Prospect Ranger District. This portion of the study area took in part of the Klamath and all of the Butte Falls BLM Resources areas (Medford District), the Butte Falls and the Prospect Ranger District (Rogue River National Forest), and substantial Boise-Cascade Corporation and Medford Corporation industrial forest land (Table 1).

Table 1. Distribution of 1981-1982 sample plots, by ownership.

| Ownership | Plots | Trees felled | Trees sectioned |
|---|---|---|---|
| | ----------- | number | ----------- |
| BLM | 44 | 235 | 141 |
| USFS | 48 | 241 | 194 |
| Boise-Cascade | 56 | 318 | 311 |
| Medford Corp. | 60 | 307 | 226 |
| Total | 208 | 1,101 | 872 |

We have collected growth information from 208 plots with measurements from about 12,500 standing trees. Of these, 1,101 trees were felled for height growth measurement with 872 sectioned for detailed volume, taper, and stem growth measurements.

Seventy-three sample trees met the qualifications for free-to-grow site-index trees (Table 2). These trees were aged at intervals along the stem to develop and evaluate site-index curves.

Table 2. Summary of 1981-1982 felled tree data, by species.

| Species | Felled trees | Site trees |
|---|---|---|
| | ------- number | ------- |
| Douglas-fir | 594 | 54 |
| White fir | 113 | 3 |
| Grand fir | 90 | 4 |
| Ponderosa pine | 113 | 5 |
| Sugar pine | 67 | 7 |
| Incense cedar | 124 | 0 |
| Total | 1,101 | 73 |

For the final field season in 1983, we plan to measure 135 plots and fall 816 trees to complete the data set. These plots will be located east of Interstate-5 in the Evans, Graves, and Cow Creek drainages. We anticipate an additional two years for model building, with release of the models scheduled for 1985.

We are interested in all available stem analysis data from southwest Oregon site trees. Anyone having data to share, please contact us. We're also happy to answer any questions regarding this project.

David W. Hann, OSU, Forest Management
Dave Larsen, OSU, FIR Growth and Yield Project
Steve Stearns-Smith, OSU, FIR Growth and Yield Project
(503)664-6272

# Continuing Education

## INTERNATIONAL FORESTRY: EXPORTING OREGON'S PRODUCTS, TECHNOLOGY, AND EXPERTISE

February 10-11, 1983. Oregon State University, Corvallis, OR. This meeting of foresters, scientists, industry representatives, and the public will provide a forum for sharing information on current activities, identifying opportunities for export, and discussing constraints on exporting and how to remove them. CONTACT: Conference Assistant, School of Forestry, Oregon State University, Corvallis, OR 97331, (503)754-2004.

## MICROCOMPUTER APPLICATIONS FOR RESOURCE MANAGERS

March 1983. Oregon State University, Corvallis, OR. This workshop will demonstrate the Apple II and other microcomputers with a variety of commercially available and special programs. A good opportunity to get hands-on experience and make side-by-side comparisons of various hardware and software. Enrollment is limited to 30 people. CONTACT: Conference Assistant, School of Forestry, Oregon State University, Corvallis, OR 97331, (503)754-2004.

## REFORESTATION: SEEDLING HANDLING AND PROTECTION

March 22-23, 1983. Oregon Institute of Technology, Klamath Falls, OR. Sponsored by OSU Forest Science Extension. Review of correct seedling handling procedures at all stages from lifting to outplanting. Especially valuable for field foresters and nursery technicians. A demonstration section will look at devices available to help detect seedling damage. Small group problem solving exercises are also part of the program. Enrollment is limited to 70. Fee is $120. CONTACT: Conference Assistant, School of Forestry, Oregon State University, Corvallis, OR 97331 (503)754-2004.

## DESIGNATED SKIDTRAILS TO REDUCE SOIL COMPACTION

April 1983. Coos Bay, OR. Sponsored by OSU Forest Engineering Extension. A one-day classroom and field workshop is being planned to discuss skidtrail layout with sale layout foresters, timber sale administrators, and loggers. Workshop includes presentations on soil compaction and principles of skidtrail layout. Field portion includes making of skid trails with a critique

to follow. Fee is $55. CONTACT: Conference Assistant, School of Forestry, Oregon State University, Corvallis, OR 97331, (503)754-2004.

FOOTHILLS FOR FOOD AND FOREST

April 25-28, 1983. Oregon State University, Corvallis, OR. International symposium sponsored by the OSU Schools of Agriculture and Forestry. Hill lands perhaps offer the greatest potential for increased food and fiber supply, and the livestock industry is a major factor in their development. This symposium will attempt to explore current development and possibilities for the future of these lands in grazing, and in the grazing/forestry interface for producing food and fiber. Program includes variety of topics related to nutrient management, prospects for growing trees and livestock together, wildlife interaction with domestic animals and forestry, and integrated forage/livestock production. CONTACT: Dr. Jim Oldfield, Department of Animal Science, Oregon State University, Corvallis, OR 97331 (503)754-3431.

YOUNG STAND MANAGEMENT IN SOUTHWEST OREGON

June 14-16, 1983. Adaptive FIR, Holiday Inn, Medford, OR. Program is in the preliminary planning stages. Topics will address management practices which affect young stand growth, as well as how young stand management decisions may affect future management alternatives. Announcements for registration will be sent out in early spring. CONTACT: Steve Tesch, Adaptive FIR.

# Of Interest

FIR PERSONNEL CHANGES - NEW HARVESTING SPECIALIST HIRED

Dave Lysne is no longer with Adaptive FIR. He has returned to the Forest Service and is presently assigned to the Rogue River National Forest in Medford where he will be working in the areas of pre-sale and logging and transportation planning. Best of luck to Dave. We will miss his contribution to the FIR Program!

We have been fortunate to hire John Mann to fill the harvesting specialist slot. John has been the director of the Mississippi State University Forestry and Harvesting Training Center in Longbeach, Mississippi for the past several years. He is anxious to return to the West where he received a master's degree in forest engineering from Oregon State University and worked as a harvesting specialist for the Six Rivers National Forest in California. He should be on board by mid-January, 1983.

ADAPTIVE FIR ANNUAL REPORT AVAILABLE

For those of you interested in a summary of the extension and research activities of the Adaptive FIR team for the period October 1981 through September 30, 1982, our annual report is available upon request. The report presents up-to-date results of on-going research projects and outlines new projects.

PRECOMMERCIAL THINNING ON LOW SITE LAND IN SW OREGON

Candidate stands for precommercial thinning have not been abundant on Site V land in southwest Oregon. Naturally regenerating conifers must compete with very well-adapted shrub species in a generally moisture-limited environment. Without intensive management, regeneration periods may last from 25 to 75 years, with full stocking never achieved among the competing vegetation. As a result few stands have needed percommercial thinning of competing conifers, but many require release treatments from competing shrubs.

Increasing skills in the establishment and tending of plantations will probably lead to more precommercial thinning opportunities in the future. Planting densities of 650 or more trees per acre have been common, with anticipated rates of mortality by stand establishment of up to 70 percent. With good site preparation and vegetation management, survival rates should increase significantly, leading to a need for precommercial thinning. What precommercial thinning density is appropriate?

A survey of precommercial thinning practices on sites in northern California and southwest Oregon indicated that where thinning had been done, and most experience was on better sites, that after-thinning densities of about 300 trees per acre were most common. Somewhat lower densities were targeted for poor sites as a precaution against stagnation or on sites where commercial thinning feasibility was limited. Locally derived growth and yield data is limited for this region; however, those surveyed have attempted to use a variety of guides and simulators generated with data from other parts of the West Coast.

Biological justification exists for precommercial thinning on poorer sites. According to Reukema and Bruce (1977) relative gains in growth from precommercial thinning are greatest on poorer sites. They indicate that a 20 to 30 percent relative improvement in site index and current gross cubic volume growth may be obtained with precommercial thinning on Site V land. On poor sites there is also concern that stand differentiation is inhibited, resulting in a tendency for stagnation.

Precommercial thinning density is most often related to a merchantability standard for the first commercial entry; generally the target is about 10 inches d.b.h. This provides for a compromise between maximum stand and individual tree growth rate up to the first commercial thinning, at which point further stocking control is used to maintain the growth rates. However, many poor sites in this region occur on steep terrain which requires cable harvesting. Increased logging costs on these sites and questionable markets for thinning products may result in many commercial thinnings never being harvested. In fact, the probability for large-scale commercial thinning ventures on the vast acreages of second-growth stands available in the future is rated as poor by many managers. What will the impact of missed commercial thinning be on the stand growth rate for the rest of the rotation? Reukema and Bruce indicate that uniform precommercially thinned stands differentiate poorly, especially on poor sites, and tend to stagnate if no further thinning is carried out. This speculation may in itself warrant wider spacing at precommercial thinning.

The density management diagram developed by Weyerhaeuser Company can be used to track stand growth at various percommercial thinning densities, enabling us to view the impact of missed commercial thinnings within a rotation of 80 years. Recall that the diagram is based on a maximum size-density relationship using relative density (RD) as a measure of the maximum growth obtainable. An RD value of .15 is obtained at about the time of crown closure; .40 is considered by many the proper time to initiate stocking control to maintain growth rates; and above a value of .55, mortality is imminent.

Table 1 shows the approximate height and age at which a stand growing on a site index 70 (King) (Site V) will reach an RD of .40. Three hundred trees per acre (tpa) results in exactly a 10-inch d.b.h. tree when RD.40 is reached at age 57 years. However, if no intermediate entry is made, the stand will be under increasingly severe intraspecific competition until final harvest. Two hundred trees per acre do not reach RD.40 until age 72, at which time the trees will be 14.4 inches d.b.h. The site has not been fully occupied early in the rotation, but crop tree growth remains maximum for a longer period of time. With 400 trees per acre RD.40 is reached at 46 years, prior to the stand reaching 10 inches d.b.h.

Table 1. Stand characteristics when RD.40 is reached, by precommercial thinning density for $SI_{70K}$.

| PCT Density | Height | d.b.h. | Age (b.h.) |
|---|---|---|---|
| 200 TPA | 85' | 14.4" | 72 years |
| 300 | 75 | 10.0 | 57 |
| 400 | 66 | 8.8 | 46 |

Stands precommercially thinned to 200, 300, and 400 trees per acre are described at age 40, 60, and 80 with no intermediate entry in Table 2. Growth rates on $SI_{70K}$ are generally slow enough that reasonable flexibility is maintained for all three densities through 80 years, but the compromise between stand growth rate and individual tree size is apparent by age 40.

Table 2. Stand characteristics by age and precommercial thinning density for $SI_{70K}$.

| Age/parameter | Density after PCT 200 TPA | 300 TPA | 400 TPA |
|---|---|---|---|
| 40 YEARS (ht = 61 ft) | | | |
| Relative density | .22 | .28 | .35 |
| d.b.h. (inches) | 9.5 | 8.5 | 8.0 |
| Vol./acre ($ft^3$) | 2200 | 2700 | 3240 |
| 60 YEARS (ht = 70 ft) | | | |
| Relative density | .35 | .44 | .53 |
| d.b.h. | 11.8 | 10.2 | 9.4 |
| Vol./acre | 3300 | 4800 | 5800 |
| 30 YEARS (ht = 89 ft) | | | |
| Relative density | .45 | .56 | .67 |
| d.b.h. | 13.2 | 11.4 | 10.5 |
| Vol./acre | 6800 | /300 | 8000 |

None of the stands have reached RD.40 yet, but considerable differences exists in d.b.h. and stand volume. By age 60 both 300 and 400 trees per acre densities have exceeded RD.40, with the 400 trees per acre density rapidly approaching the zone of imminent mortality. By age 80 all three densities have exceeded RD.40, but the 200 trees per acre density has produced significantly larger diameter trees. Stand volume growth has declined in the 400 trees per acre density to the point where the 300 trees per acre density is nearly equal in biomass, but contains one-inch diameter larger trees.

One must certainly keep in mind the respective management situations when evaluating Table 2. Can the organization place a value on the extra diameter growth, or are alternative regimes based solely on cubic foot growth? From the standpoint of either situation, if a commercial thinning is missed and a final harvest planned for 80 years, a 300 trees per acre precommercial thinning density appears to present a reasonable compromise between stand and individual tree growth on Site V land in southwest Oregon.

S.T.

## DROUGHT RESISTANCE OF DOUGLAS-FIR IN SW OREGON

Initial results of a study to compare the relative drought resistance of 200 Douglas-fir families collected between Roseburg and the California border are available. The study is a cooperative venture between the OSU School of Forestry, the Forest Service, and the BLM. Seed was collected from two parent trees, each representing a different family, at each of about 100 locations along the latitudinal transect. Most seed was collected by the BLM, and the seedlings were grown in the BLM nursery at Merlin. The seedlings were transplanted to controlled soil environment bins at the Forest Research Lab in Corvallis where they received no moisture input from the end of April until mid-October.

Increased drought resistance, as measured by seedling survival under controlled soil moisture conditions, was strongly correlated with decreasing latitude of seed source; that is, the seedlings from southerly collections were more drought resistant. Movement of seed from the California border to Roseburg is not recommended, but collection of seed from the southern end of a seed zone would be appropriate.

About 25 collection sites were characterized as either mesic or xeric. Within this rather limited sample, survival of seedlings whose parents were located on xeric sites was about twice that of those seedlings from mesic sites. This result suggests that ecotypic adaptation to the harsh environment exists and that it may be a good idea to plant droughty sites with seedlings whose parents were located on droughty sites.

A rule of thumb for harsh site reforestation may be to use seed obtained from xeric sites located in the southern extreme of the respective seed zone.

D. P. Lavender, OSU, Forest Science

# Recent Publications

For copies of the publications cited, mail your requests to the appropriate address as indicated by the number following each summary. Requests should be sent to:

1 Conference Office
323 Agricultural Sciences
Washington State University
Pullman, WA 99164

2 Publications
Pacific Northwest Forest and Range Experiment Station
809 NE 6th Avenue
Portland, OR 97232

SITE PREPARATION AND FUELS MANAGEMENT ON STEEP TERRAIN, by D. M. Baumgartner (ed.). 1982. Cooperative Extension, Washington State University, Pullman, WA. 197 p. Twenty-four papers discuss site preparation equipment and techniques, related influences and concerns, and vegetation responses in the northern Rocky Mountains. Techniques for site preparation covered include machines, fire, handscalps, and chemicals. Fifteen papers cover the use of prescribed burning, particularly the response of western Montana vegetation types to burning. Site preparation influences on site productivity, duff reduction, importance of residual organic debris, insolation and heat effects, animal use and damage, and landscape design are covered individually. Cost $11.50.

1

BRUSH CONTROL WITH HERBICIDES ON HILL PASTURE SITES IN SOUTHERN OREGON, by L. A. Norris, M. L. Montgomery, L. E. Warren, and W. D. Mosher. Silvex alone or with 2,4-D in a 1:1 ratio at about 3 or 4 kg/ha gave 60 to 100 percent control of many brush species including poison oak, Oregon oak, and maples. Picloram at 1 kg/ha plus 2,4-D at 4 kg/ha was most effective with respect to the amount of picloram; however, the mixture of 1 kg/ha plus 2 kg/ha, respectively, was nearly as good. Complete pasture renovation in this area requires brush control, burning, fertilization, and seeding of desirable species. Picloram and 2,4-D disappear from soils in 29 months with no significant leaching into the soil profile at these study sites. Herbicide discharge in streamflow was small, representing 0.35 percent and 0.014 percent of applied picloram and 2,4-D. We believe that nearly all of the herbicide discharged from these watersheds represents residue from adjacent streambanks. Significant overland movement of herbicides from upslope did not occur on these study areas. The probability of crop damage from irrigation with water from these watersheds is low.

2

ENVIRONMENT, VEGETATION, AND REGENERATION AFTER TIMBER HARVEST IN THE APPLEGATE AREA OF SOUTHWESTERN OREGON, by D. Minore, A. Abee, S. D. Smith, and E. C. White. 1982. USDA Forest Service Research Note PNW-339. Pacific Northwest Forest and Range Experiment Station, Portland, OR. 15 p. Multiple regression analyses were used to relate environmental factors and vegetation to post-harvest forest regeneration in the Applegate area of southwestern Oregon. Optimal environments for regeneration were identified by aspect, slope, elevation, rock cover, and vegetation. The authors concluded that gently sloping northern aspects on deep soils at elevations below 4,000 feet are optimal for clearcut regeneration. They found hotter sites could be regenerated naturally if sufficient overstory is maintained, but underplanting was recommended where prompt regeneration is required.

2



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# FIR Report

## SPRING 1983

VOL. 5 NO. 1


"FIR REPORT" is a quarterly newsletter containing information of interest to individuals concerned with forest management in southwest Oregon. It is mailed free on request. Requests should be sent to: FIR REPORT, 1301 Maple Grove Drive, Medford, Oregon 97501.

FIR REPORT communicates recent technological advances and research pertinent to southwest Oregon, and alerts area natural resource specialists to upcoming educational events. Comments and suggestions concerning the content of "FIR REPORT" are welcome and should be sent to the Maple Grove address.

The Southwest Oregon Forestry Intensified Research Program (FIR) is a joint effort between the School of Forestry at Oregon State University and the Pacific Northwest Forest and Range Experiment Station of the U.S.D.A. Forest Service. It is designed to assist region foresters and other specialists in solving complex biological and management problems unique to southwest Oregon. FIR specialists organize, coordinate, and conduct educational programs and research projects specifically tailored to meet regional needs.

Established in October, 1978, the FIR Program is supported by Oregon State University, the Bureau of Land Management, U.S.D.A. Forest Service, O & C Counties, and southwest Oregon timber industries. It represents a determined effort by the southwest Oregon forestry community and county governments to find practical solutions to important forest management problems.

For the FIR Staff

Ole T. Helgerson

Ole T. Helgerson
Silviculture Specialist

## Inside




OREGON STATE UNIVERSITY EXTENSION SERVICE

FORESTRY INTENSIFIED RESEARCH

SERVING SOUTHWEST OREGON THROUGH RESEARCH AND EDUCATION

# FIR Specialists


OLE HELGERSON, Silviculture

STEVE HOBBS, Reforestation

JOHN MANN, Harvesting

DAVE McNABB, Watershed

STEVE TESCH, Silviculture



# FIR

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NOTES FROM THE EDITOR

With this issue, editorial responsibility shifts from Steve Tesch to Ole Helgerson. Many thanks to Steve for his good work over the last year!

Please note that we need the assistance of you--our readership--in maintaining and upgrading the usefulness of the FIR REPORT. Our central goal is to share the best and most up-to-date information on the management of forests in southwest Oregon, with special focus on reforestation problems. Please keep us informed of research or study results or your ideas or concerns.

Because of space limitations, results described within Current Research appear as extended abstracts. Readers who are interested in learning more about individual studies are encouraged to contact the study's investigator or otherwise wait for publication of a more complete description in typically a refereed journal.

Ole T. Helgerson

ERRATA-

In the last issue of the FIR REPORT 4(4) there was a typographical error in the article on precommercial thinning by Steve Tesch. In the first paragraph on page 11, the article suggested a relative density value of .04 is considered by many the proper time to initiate stocking control to maintain growth rates. The correct relative density value should be .40, as was used throughout the rest of the article.

# Current Research

USING A PRESSURE CHAMBER TO DETECT FREEZING DAMAGE TO SEEDLINGS

Cold storage of seedlings is often a necessary step in the reforestation of conifers in the Pacific Northwest. Despite improvements in the overall quality of refrigeration facilities, occasional equipment malfunctions still occur which can result in seedlings being exposed to sub-freezing temperatures. Such exposure can be especially injurious to root systems which are believed to be more sensitive to freezing than shoots. Unfortunately, we know little about the tolerance limits of roots to this type of injury. Also, there is no simple and effective method of identifying the extent of injury. Consequently, when a storage problem like this is discovered, foresters are often left scratching their heads and wondering if they should throw out or plant the exposed seedlings.

In December 1982, a study was initiated to determine if a pressure chamber device could be effectively used to identify seedlings that were severely damaged by freezing. Groups of 10 bareroot 2-0 Douglas-fir seedlings supplied by the Medford Nursery were placed in a programmable freezing chamber and exposed to ten temperatures ranging from -3°C to -12°C. Afterwards, they were put in a cold room for 24 hours and then planted in pots. A small lateral branch from each seedling was removed for measuring plant moisture stress (PMS) with a pressure chamber on the first, fourth, and sixth days after planting.

Most of the 20 seedlings which died were those exposed to the lowest freezing temperatures, -11°C and -12°C. There was a close correlation between seedling mortality and the percent change in PMS from the first to the third measurement date (one and six days after planting). The PMS of seedlings which subsequently died tended to go up greatly during this five day interval, while the increase in PMS of surviving seedlings was much smaller. Of the 20 seedlings with the largest percent increases in PMS, 17 subsequently died. A similar relation between increased PMS and seedling mortality also appeared between the first and second measurement date, but was less dramatic.

These data suggest that a pressure chamber can be a very useful tool in identifying seedling injury caused by unintentional freezing during cold storage. This assessment procedure is simple, requiring only a pressure chamber and a small amount of greenhouse or growth room space, and can be completed within a week after the suspected injury occurs. For additional information contact Doug McCreary, Forest Research Lab, Oregon State University, Corvallis, OR 97331, telephone (503) 753-9166.

Doug McCreary
OSU, Forest Science

## NURSERY COOPERATIVE FORMED TO IMPROVE SEEDLING QUALITY

The objective of the Nursery Technology Cooperative, officially formed on July 1, 1983, is to improve nursery productivity in the Northwest. Members include nurseries and seedling users. Present activities include (1) applied studies, (2) continuing education, and (3) technical assistance. The Nursery Technology Cooperative will be a clearinghouse of information for nursery and regeneration technology.

In our first study, we will be assessing the effects of top pruning on seedling growth and survival. Top pruning is a common nursery practice, about which little information is available. A few of the questions we will be addressing include:

1. Does pruning result in a more uniformly sized crop?

2. Are unclipped seedlings within a pruned bed "released?"

3. What is the effect of pruning on survival and growth in the field?

The Nursery Technology Center is now also coordinating the seedling vigor evaluation program conducted at Oregon State University. In addition to providing this service, we are initiating studies to improve current testing procedures. This year we will carry out a research project designed to evaluate the ability of the vigor evaluation method to predict seedling survival and growth under closely controlled field conditions. This study will also compare the vigor evaluation method with the approach of measuring root regeneration capacity. We are also conducting studies aimed at developing new techniques of assessing seedling quality (see "Using a Pressure Chamber to Detect Freezing Damage to Seedlings" in the Current Research section).

Anyone interested in our activities at the Nursery Technology Cooperative should contact Mary Duryea, Forest Research Lab, Oregon State University, Corvallis, OR 97331, telephone (503) 753-9166.

Mary Duryea
OSU, Forest Science

## GLYPHOSATE IN PACIFIC NORTHWEST FOREST ECOSYSTEMS - FATE AFTER AERIAL APPLICATION

Glyphosate residues were evaluated in forest ecosystems which received maximum rates of application, 3.3 kg/ha, by aircraft. Deposits were recorded on foliage and on mylar targets at various depths within the forest canopy to determine where interception was occurring. Residues in foliage, ground litter, and soil were documented. Animals feeding on vegetation, animal matter and mixed diets were trapped and their body contents were analyzed for glyphosate and metabolites. A stream which received direct spray within the sprayed area was followed to determine rates of glyphosate degradation in water and sediments. Coho salmon fingerlings were held in the stream to determine their ability to collect glyphosate from contaminated water. Half-lives of glyphosate in foliage and litter ranged from less than 10 to 14 days at the various levels in the canopy. Persistence was twice as great in soil. Total stream contamination peaked at 0.27 mg/liter and decreased rapidly after application. Sediments reached higher concentrations than water and retained them longer. Mammalian exposure and retention varied with food preference. Carnivores and herbivores alike maintained visceral contents at or below observed levels in ground forage and litter. Body concentrations remained substantially below visceral concentrations, indicating a more rapid elimination than absorption of glyphosate from food supplies. Concentrations in bodies remained below those of food supplies, indicating that higher trophic feeders in food chains have progressively less glyphosate in food supplies with each trophic level. Aminomethyl phosphonic acid was found at low concentrations on foliage and other samples, and degraded rapidly. N-nitrosoglyphosate residues were at or below the detection limits.

Michael Newton, Oregon State University
Bruce R. Kelpsas, Forest Research Lab
Kerry M. Howard, Sealaska Corporation
Roy Danhaus, Monsanto Corporation
Sam Duberman, Monsanto Corporation
Marlene Lottman, Monsanto Corporation

## GRASS CONTROL INCREASES SEEDLING SURVIVAL - SPECIAL ROOT COATING DOESN'T HELP

A comparative study with the Coos Bay BLM District, designed to test the effects of grass control and a special root coating on the survival of planted Douglas-fir seedlings revealed that vegetation management is more important. In the winter of 1982, bareroot 2-0 Douglas-fir seedlings were planted across three vegetation control treatments with and without receiving the special root coating. The test site, located in the Panther Creek drainage near Coos Bay, Oregon is a south-facing hillside (30-50 percent slope) at an elevation under 1,000 feet. Grass covered the entire area, poison oak was present in scattered clumps and the site held scattered incense cedar and Douglas-fir. The soil is a gravelly loam less than 20 inches deep.

The grass control treatments included a 36 by 36 inch area treated with glyphosate or paper mulch and untreated control areas. Combined with these treatments, seedling roots were treated or not treated with a Terra Sorb® slurry. Terra Sorb® is a hydrolysed starch material that is capable of absorbing many times its own weight in water. It was applied to seedling roots by dipping bundles of 50 to 100 seedlings in the recommended slurry before the seedlings were placed in planting bags.

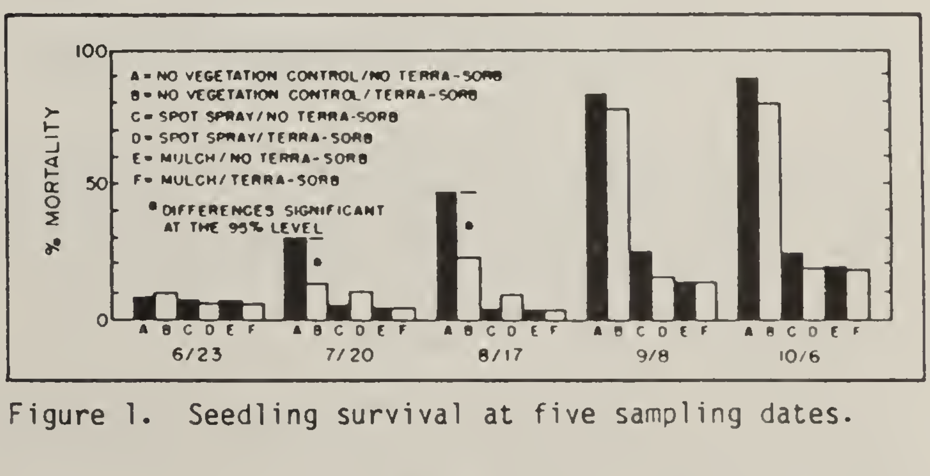


Figure 1. Seedling survival at five sampling dates.

Seedling survival was measured on five dates during the growing season (Figure 1). Terra Sorb® alone did not reduce mortality at the end of the growing season but did appear to have a beneficial effect earlier on July 20 and August 17. Mulching and spot spraying, however, kept seedling mortality at similarly low levels

through the growing season regardless of whether the seedlings were treated with Terra Sorb®. Compared to a single treatment with glyphosate, the paper mulch required maintenance at three week intervals to replace paper displaced by elk. About 70 percent of all seedlings with paper mulch required extra tending.

The results mirror those from a study of grass control in the Roseburg area that has been reported in previous issues of the FIR REPORT (3(2), 4(3)). Control of grass competition pays large dividends in seedling survival, and among control methods, herbicides are hugely more cost effective than mulching.

The Terra sorb® material was tested on another site (Monument Peak) on Boise-Cascade land near Detroit Lake. Douglas-fir and noble fir seedlings that had been stored for three months were planted during warm dry weather in late June 1982 on a 35 to 45 percent slope which faces south to southwest at an elevation of 4,300 feet. Huckleberries, grass and, to a lesser degree, beargrass were the main competitors on the recently clearcut site. No vegetation control was applied. The seedlings were again treated with Terra Sorb® before being placed in the planting bags. At this location, the seedlings treated with Terra Sorb® did not perform as well as the untreated controls (Table 1).

Table 1. First year survival at Monument Peak site (percent).

| Species | Untreated controls | Treated with Terra Sorb® | Significance level between seedling treatments |
|---|---|---|---|
| Douglas-fir | 70 | 60 | p .1 |
| Noble fir | 67 | 52 | p .01 |

The results from these two study sites indicate that while Terra Sorb® may provide a temporary advantage earlier in the growing season, it is not a substitute for grass control. Furthermore, it does not appear to increase seedling survival at the end of the first growing season, appearing instead to increase seedling mortality.

Dave DeYoe
OSU, Forestry Extension

METHOD OF FIRST YEAR SHADING AFFECTS SECOND YEAR SURVIVAL

Although shadecards are commonly used on Douglas-fir seedlings planted on south facing sites, a new product, Reemay Sleeves®, cylinders of spun polyester which provide effective protection against deer browsing, also seemed to have potential for providing protection to seedlings from lethal heat loads. To test this idea, 2-0 bareroot Douglas-fir seedlings were given shadecards, Reemay Sleeves®, or left as unshaded controls in a randomized complete block study located near Butte Falls, on the Rogue River National Forest. The study site, a brushfield which had been mowed by a Trac-Mac, faces southwest with a slope averaging between 15 and 20 percent and is at an elevation of 4,200 feet. The shadecards were the variety that has the wooden stake woven through slits in the card and the Reemay Sleeves® were long enough to entirely cover the seedlings.

Seedling survival was measured in early August and September 1981 (before and after a prolonged three week long heat wave) and in August 1982. Seedling survival before the heat wave differed little between treatments, averaging 98, 100 and 92 percent for controls, shadecards and Reemay Sleeves®, respectively (Figure 1). After the hotspell, however, survival of seedlings enclosed by Reemay Sleeves® had dropped subtantially--to 62 percent--whereas survival of the controls and seedlings with shadecards was still high (92 and 97 percent, respectively).

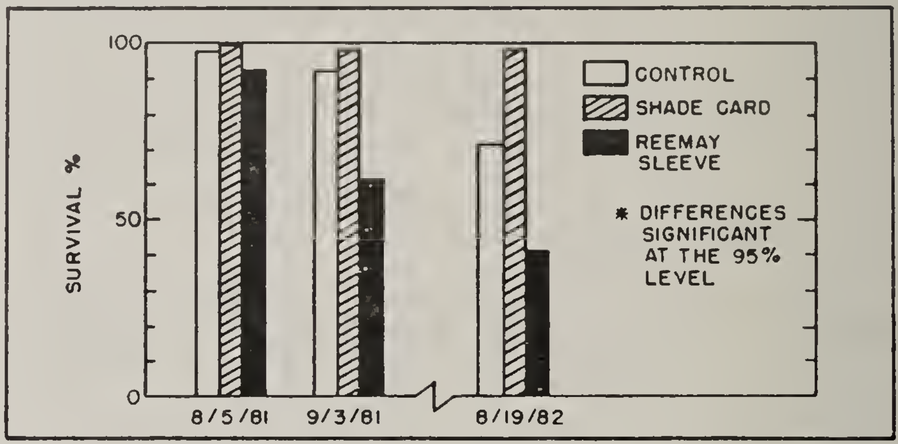


Figure 1. Survival differences by shade treatment.

Seedling survival at the end of the second year tells a more complete story. During the previous winter, snow loading had collapsed the shadecards around the wooden stakes. Nonetheless, survival of the seedlings with the shadecards remained high through the second growing season, but survival of the controls and seedlings in the Reemay Sleeves® continued to drop. Because the shadecards provided less shade in the second growing season, it is plausible that the continued high survival of seedlings with shadecards was in part related to an effect carried over from the first year.

Although survival of the controls and seedlings receiving shadecards was very similar at the end of the first growing season, the shadecards may have reduced the physiological stress on the seedlings during the first year allowing them to maintain their higher survival during the second year compared to the decrease in survival for the controls or the seedlings in the sleeves.

The drop in survival during the heat wave that was observed for the seedlings in the sleeves indicated that this effective method of browse protection should be avoided on sites receiving radiation loads similar to the ones in this study. The continued high survival of seedlings protected by shadecards indicated that survival of Douglas-fir should be enhanced into the second year on sites receiving similar radiation loads.

Dave DeYoe
OSU, Forestry Extension

# Adaptive FIR

SEEDLING SURVIVAL AND BRUSH COMPETITION

The brushfield ecology project located on Negro Ben near Ruch is undergoing a shift in emphasis this spring. The new phase of the study will address the effects of four levels of competition from resprouting brush on the survival and growth of planted Douglas-fir seedlings (1-0 plugs).

In May 1982, the two units which had total brush removal in 1980 (FIR REPORT 3(3):2-3) were split with half of each unit sprayed with Garlon 4E in oil to kill all the resprouting greenleaf manzanita and canyon live oak. At the time of spraying, many resprout clumps were 2-3 feet tall and will provide some dead shade for planted seedlings this summer. The brush in the other subunits continues to grow and will represent fourth year resprouts this coming summer.

In February 1983, four additional subunits were handslashed with complete brush removal. Brush-stumps on subunits will be allowed to resprout to provide first year resprout competition for the planted seedlings. In the other two subunits, the seedlings will be covered and the resprouting brush sprayed in late spring before soil moisture is drawn down. Seedlings will be planted in late February or early March 1983.

A summary of the treatments follows:

1. Brush removed, first year resprouts killed in late spring (maximum soil moisture, no shade).
2. Two-year-old resprouts killed (maximum soil moisture, some dead shade).
3. First-year resprouts (reduced soil moisture, some live shade by late summer).
4. Fourth-year resprouts (minimum soil moisture available to seedlings, live shade immediately).

As stated in the previous FIR REPORT article, the test site is a 66 percent west-facing slope at 3,600 feet elevation. The soil is a skeletal Xerochrept with a surface mantle of ravel. The results of this study should help determine the need for vigorous vegetation management on tough-to-regenerate sites such as this.

S. T.

SKIDDING ATTACHED TOPS TO REDUCE FUEL LOADING

Designated skid trails are being used more frequently to minimize soil compaction during logging; however, foresters often find themselves in a dilemma over how to treat residual fuels when broadcast burning is not feasible. One alternative is to leave tree tops attached to the uppermost merchantable log, which is then skidded to a central landing for bucking and top disposal. This practice results in some long logs being turned into skid trails, which may cause extra damage to residual crop trees in a commercial thinning. Tops are often broken off during this turning process, so a fundamental question is how successful is this practice in reducing fuel loadings.

As previously noted in the FIR REPORT (3(3):2, 4(2):3-9) a study has been undertaken on the Rogue River National Forest near Union Creek to address this issue from the perspective of logging production, residual stand damage, and fuel loading. The study was conducted in a commercial thinning (mean d.b.h. of cut trees = 13 ± s.d. 8 inches) that used designated skid trails spaced at average intervals of 140 feet. Tops were left attached to trees and skidded to the landing from every other area between skid trails.

Results from the logging production phase of the study indicated that skidding attached unmerchantable tree tops to the landing did not reduce logging productivity and that pulling winch line out to logs from a designated skid trail resulted in the same skidding time per turn as driving directly to the logs for chokering.

Residual stand damage was measured after most "rub trees" near the skid trails had been removed. No significant difference ($p = .05$) was found between the percent of leave trees damaged in the area from which tops were skidded (18.6 ± s.d. 17.6%) and the area in which tops were left in the woods (11.9 ± s.d. 8.6%). Nor did the average size of bole scars differ between the two areas. Average scar size when tops were left in the woods was 1.57 ± s.d. 1.9 square feet versus 1.45 ± s.d. 1.6 square feet when tops were skidded to the landing.

A great deal of variation was observed in post-logging fuel loads, but preliminary analyses indicate no significant difference ($p = .05$) between total fuel loadings in the area from which tops were removed (85.2 ± 69.9 tons/acre) and the area in which tops were left in the woods (64.9 ± 30.9 tons/acre). Prelogging fuel loadings had been virtually identical between the two areas at about 43 tons/acre. These results held for the 0-9 inch diameter fuel class; no significant difference was observed between the two treatments.

In assessing the importance of tops in fuel loads, it is important to note that many tree tops were broken when logs were turned into the skid roads and that the logger was not required to choker broken tops separately. In the logging production study, twice as many tops were removed from the top-yarded area, a significant difference. It appears, however, that the larger limbs which were removed from lower logs and left in the woods in both areas constitute a large enough portion of the post-logging fuels to outweigh the difference in numbers of tops removed.

As practiced in this timber sale, where only tops attached to logs are required to be skidded, logging production was not reduced and residual stand damage was not increased, but the practice was ineffective in reducing post-logging fuel loadings below a level obtained by bucking and leaving tops in the woods.

S. T.

SHADECARDS MAY DECREASE DEER BROWSING

As reported in the last issue of the FIR REPORT (4(4):4), a study examining artificial shading of Douglas-fir seedlings is underway. During the first growing season some interesting browsing patterns were observed that may be related to shade protection (Table 1).

Table 1. Percent seedlings with browsing damage at Julie Creek study site (3 replications averaged.

| Control | Cups | Shadecard placement East | Shadecard placement South |
|---|---|---|---|
| 33 | 31 | 9 | 12 |
| a | a | b | b |

Treatment means with different letters differ at p = .05.

The site, Julie Creek, is a south-facing 20 acre clearcut at about 3,100 feet. Douglas-fir seedlings were operationally planted in May, due to a late snowpack. The trees were not protected against deer browsing. After planting, FIR personnel installed the four shade treatments in a randomized block design with three replications. The treatments are south-facing shadecards, east-facing shadecards, styrofoam cups inverted around the base of the seedlings, and unshaded seedlings (control). Treatments were installed without regard to potential browsing activity.

Observed patterns in deer browsing between treatments were measured and tested by ANOVA which indicated that a significant difference (p = .05) existed between treatments. A Multiple Comparison Test indicated that browsing was significantly less (p = .05) on the shadecard treatments compared to the cups and controls. Nearly one-third of the seedlings in the control or styrofoam cup treatments were browsed, whereas only slightly more than 10 percent of the seedlings with shadecards received browsing. The placement of the shadecards may be a key factor; all were placed within six inches of the seedlings with the top of the shadecard angled towards the seedling leader, often touching it.

Thus, a possibility exists that visual or mechanical obstruction by the shadecards reduced deer browsing. Because of the availability of other seedlings without shadecards or other protection from browsing, it is unknown whether placing shadecards by all seedlings would have also reduced deer browsing by the same amount.

The results of this study indicate, however, that in addition to offering seedlings protection from heat, shadecards installed close to Douglas-fir seedlings have a potential to significantly reduce browse damage in the first growing season after planting.

Jim Bunker
FIR Research Assistant

## EFFECTIVENESS OF DRY-SEASON PRECIPITATION IN PARTIALLY RECHARGING THE SOIL PROFILE

Data from the new dry-season precipitation map (precipitation occurring between May and September 30) are being used by several FIR research projects to characterize the climate of southwest Oregon. For example, this information is being used with the soil moisture storage to help characterize the amount of water potentially available to newly planted seedlings in the Adaptive FIR study of reforestation potential of withdrawn BLM lands.

An uncertainty which remains, however, is how effective dry season precipitation is at recharging the soil profile. To address this question, I have collected additional data to determine the number of storms that have the potential to do this.

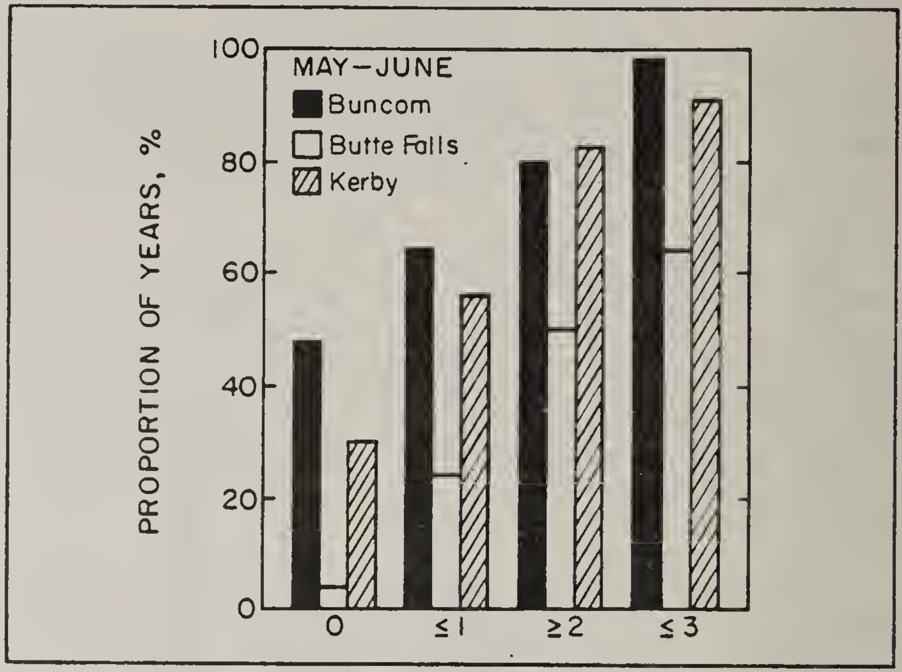


Figure 1. Cumulative number of storm events ≥ 0.5 inch/48 hours.

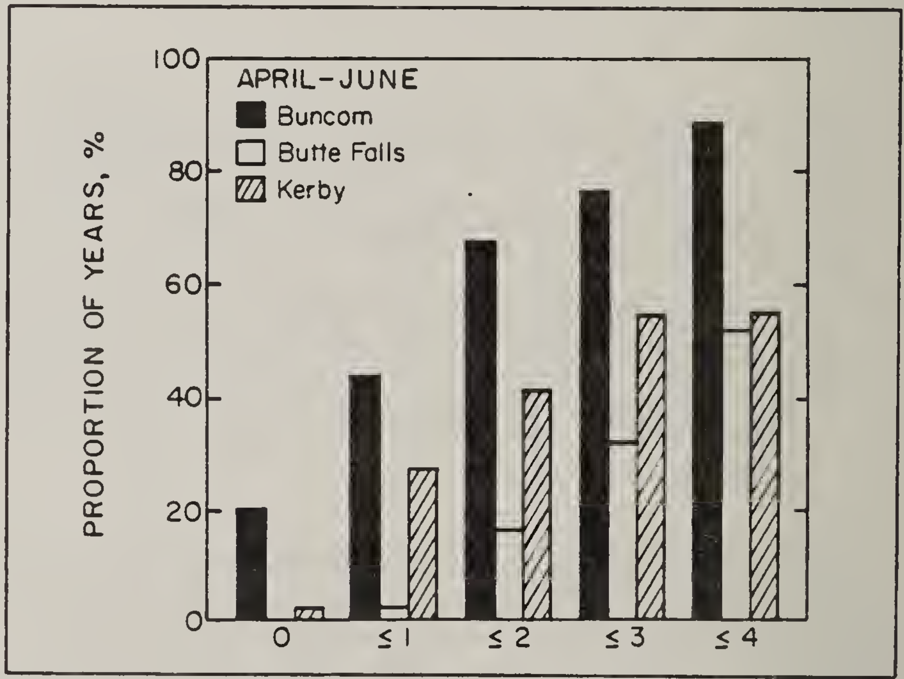


Figure 2. Cumulative number of storm events ≥ 0.5 inch/48 hours.

A storm with this potential was defined as producing at least 0.5 inches of precipitation in 48 hours. During the spring and early summer this amount of precipitation should rewet the seedling root zone in most skeletal soils. Forty-eight hours was used as a base time to include slow moving storm fronts with low daily totals. Daily precipitation data were analyzed over the past 25 years (1957-1981) from ten stations: Brookings, Buncom (Little Applegate Valley), Butte Falls, Crater Lake, Drain, Glendale, Kerby, Medford, Sexton Summit, and Steamboat Ranger Station.

July and August are the driest months and are also least likely to receive a ≥ 0.5 inch storm. At five locations, two or fewer of these storms occurred in July

over the past 25 years. The Cascades and Coast are more apt to receive ≥ 0.5 inch storms but still have not received this amount of precipitation in either of these months for half of the years on record. At several locations, the distribution of 0.5 incn storms in September is similar to August.

The chance of ≥ 0.5 inch storms occurring earlier during May and June at lower elevations in the interior Rogue Basin is much lower than at other locations. Buncom, which receives on the average less than four inches of dry season precipitation, has not received a ≥ 0.5 inch storm during May-June in 12 of the past 25 years (Figure 1). The chance for Buncom and Kerby receiving more than three of these storms in May-June is also very low. The probability for a location to receive more than four storms improves, however, for areas where dry-season precipitation exceeds about six inches.

The chance of at least one ≥ 0.5 storm occurring in a given year improves if storms in April are included (Figure 2). The Buncom site is still drier than other locations, however, going without a storm during April-June during one year out of five and receiving only one storm during one year in four.

The probability of less than one or less than two ≥ 0.5 inch storms occurring in either May-June or April-June is significantly related to the average amount of dry-season precipitation (DSP) a site receives. The following equations can be used to predict the percent of time that lower number of storms will occur.

| Months | Number of storms | Equation | $R^2$ |
|---|---|---|---|
| May-June | ≤ 1 | % time = 97.6 - 10.1 DSP | 0.75 |
| May-June | ≤ 2 | % time = 119.6 - 10.6 DSP | 0.77 |
| April-June | ≤ 1 | % time = 70.5 - 8.6 DSP | 0.72 |
| April-June | ≤ 2 | % time = 92.7 - 10.6 DSP | 0.75 |

The equations are valid for dry-season precipitation amounts between three and ten inches.

The relevance of this information to reforestation success in southwest Oregon is not well documented, but first year seedling survival can be quite good when a site receives only one ≥ 0.5 inch storm during May and June. One similar storm in late June occurred during the first year after planting on the machine site preparation study site (FIR REPORT 4(4):2-3). First year survival of ponderosa pine at China Gulch in the Applegate Valley was between 98 and 100 percent (FIR REPORT 4(3):3-4), although the site received only one storm in April-June, with the second major storm event not occurring until October.

Having at least one dry-season storm event may help seedling survival. To minimize the risk of reforestation failure if ≥ 0.5 inch storms do not occur in May and June, seedlings should be planted as early in the year as possible in low dry-season precipitation areas. This increases the likelihood of having a ≥ 0.5 inch storm event occurring after planting. Vegetation management in these areas is also extremely important to insure that water from the few storm events that do occur will be available to seedlings and not be lost to weeds.

D. M.

# Fundamental FIR

## WATER USE BY WHITELEAF MANZANITA AND GROWTH OF CONIFER SEEDLINGS

Foresters in southwest Oregon involved in stand establishment and young stand management are interested in knowing to what degree brush competition affects the mortality rates and growth of young conifer stands. A Fundamental FIR project, FS 112, is currently underway to better define these relationships.

One study within the project will examine the effects of water use by whiteleaf manzanita on the survival and growth of planted Douglas-fir and ponderosa pine seedlings across five densities of manzanita seedlings ranging from a two by two to an eight by eight foot spacing, with plots free of manzanita to serve as controls.

The study is designed to run for at least two years. During this time information will be collected on soil moisture depletion, transpiration by manzanita, and plant moisture stress of manzanita and conifer seedlings. Seedling heights and basal diameters will also be measured at the end of each growing season.

This information will prove useful in testing the null hypotheses that manzanita has no effect on water availability, survival and growth of conifer seedlings, and will also help to better define functional relationships between density of manzanita and conifer growth.

Diane White
Forest Science, OSU

## KIND AND INTENSITY OF EVERGREEN SHRUB COMPETITION IN SOUTHWESTERN OREGON CONIFER FORESTS

It has been demonstrated that growth of crop trees can be increased by controlling vegetation that competes with trees for such site resources as light and moisture. Little is known quantitatively, however, about how specific levels of vegetation control affect young conifer productivity. The objective of this study is to better define how evergreen shrub species common to southwest Oregon influence the survival and growth of Douglas-fir seedlings.

Seven levels of vegetation control have been installed around individual Douglas-fir seedlings planted in 15 replications in one two-year old clearcut and across 10 replicates in another within the Illinois Valley Ranger District, Siskiyou National Forest. The treatments are: (1) no vegetation removal (control); (2) one-half of the vegetation removed within a 4-foot radius around the seedlings; (3) one-half of the vegetation removed within a 9-foot radius; (4) one-half of the vegetation removed within a 12-foot radius; (5) all vegetation removed within a 4-foot radius; (6) all vegetation removed within a 8-foot radius; and (7) all vegetation removed within a 12-foot radius. The Douglas-fir seedlings wer 2-0 bare-roots planted the year before the treatments were installed. Major competitors present are tanoak, madrone, manzanita, poison oak, snowbrush, and deerbrush. Periodic measurements are being made on

height and diameter of conifer seedlings, shrub resprouting and growth, soil moisture levels, and soil temperatures.

Averaged over the first two growing seasons since the treatments were applied, seedling growth increased as the amount of surrounding vegetation decreased. For instance, where one-half of the vegetation was removed within a 12-foot radius (1/2 x 12), seedling heights were 1.1 times greater than control seedlings and were 1.5 times taller where all the vegetation was removed within a 12-foot radius (T x 12).

Diameter growth trends were similar: Seedling diameters in the 1/2 by 12 plots were 1.6 times larger than the controls, and in the T x 12 plots seedling diameters were 2.8 times larger than control seedlings.

The largest growth differences occurred, however, during the second growing season. In comparison to the two year average, seedlings in the T x 12 plots grew 2.2 times more in height, and 7.0 times more in diameter, than did the control seedlings.

Conifer growth data will be collected for at least three more growing seasons on all plots, then compared with soil moisture levels and shrub characteristics such as height growth and number of resprouts.

Annabelle Jaramillo, Botanist
PNW Forestry Sciences Lab, Corvallis

SEED PRODUCTION FROM SHELTERWOOD STANDS IN THE CASCADES

A study initiated by Dick Williamson in 1971 measured the production of sound seed in shelterwood and adjoining uncut stands located in the Oregon and Washington Cascades over different four and five year periods. Four study sites were located in the Tiller Ranger District, Umpqua National Forest. The shelterwood stands were logged by tractors and received site preparation after harvest either by broadcast burning or by burning slash piled by tractor.

In the first year after the seed cuts, all five shelterwood stands produced from two-thirds to as much sound seed as did the adjoining uncut stands, even though the shelterwood overstories had no more than half the number of dominant trees. By the second year and beyond, total seed fall under the shelterwoods was nearly equal to or slightly greater than under the uncut stands. Average total seed production for five years tended to be greater for the shelterwood stands (411,000 seeds/ac/5 yrs) than for the controls (330,000 seeds/ac/5 yrs), although huge variation existed within and between locations and between years.

Regeneration surveys and seed fall data on two shelterwoods within the south Umpqua drainage were used to estimate a seedling-to-seed ratio of about 1:1000. For similar units on gentle topography which receive similar site preparation, natural seeding has the potential to adequately restock a stand. For this potential to be realized, however, competing weeds and animal damage must be controlled, and care must be exercised during overstory removal to avoid damage to seedlings which could reduce stocking below acceptable levels. For more information contact: Dick Williamson, PNW, 3625 93rd Avenue S.W., Olympia, WA 98502, telephone (206) 953-9470.

Dick Williamson, USFS

# Continuing Education

## YOUNG STAND MANAGEMENT IN SOUTHWEST OREGON

June 14-16, 1983. Adaptive FIR, Holiday Inn, Medford. The presentation of information will use a symposium format on the first day; a field trip to view an array of young stand management opportunities, including some research results will be held on the second day; and a guided design exercise using growth simulators and economic analysis will follow on the third day. Participants may register for the first day only, or for all three days. The first day is intended for a general audience; days two and three will be more challenging and are intended for professional foresters involved in writing prescriptions and planning. Announcements for registration will be mailed by May 1, 1983. CONTACT: Elaine Morse, Adaptive FIR.

## NORTHWEST FOREST SOILS COUNCIL SUMMER MEETING

July 17-19, 1983. Longview, WA. Summer field trip will be in the Mt. St. Helens area. Hosts are Weyerhaeuser Company and Gifford Pinchot National Forest. Erosion, revegetation and regeneration on several sizes and depths of ash will be observed by traversing the blast zone from west to east. CONTACTS: Steve Webster, Weyerhaeuser (206) 924-6325 or Steve Hawse, Forest Service, R-6 (503) 221-6858.

## TRACKING NUTRIENTS AND PRODUCTIVITY WITH FORCYTE

July 11-12, 1983. Oregon State University, Corvallis. Acquaint forest researchers and managers with the FORCYTE simulation model. The model is designed to simulate nutrient changes in forest ecosystems associated with different harvesting strategies and management practices. Half the time will be spent in lecture and half the time spent evaluating computer simulations. Limited to 35. CONTACT: Conference Assistant (503) 754-2004.

## SAF CONTINUING FORESTRY EDUCATION

Foresters and allied professionals have a unique opportunity to gain professional recognition for participation in continuing education and professional development. Because of advancing technology, increasing public concern and ever changing regulations, resource professionals must continually acquire knowledge to remain effective. The Society of American Foresters' CFE program provides a framework by which SAF members and non-members alike can be recognized for their initiative in professional development.

A CFE Certificate is awarded for completing 150 contact hours of continuing forestry education and professional development during a three year period across six categories of participation. The categories include taking organized course work in forestry or complementary fields, presenting information, and giving service to resource organizations. The key to being awarded hours is that the CFE activities must lie outside the general realm of the individual's job activities.

The CFE program is important. It is also based on the initiative and integrity of its participants to keep track of their own CFE hours. Individuals who wish to participate should contact their local SAF Chapter Scholarship Chairman; or Denny Lavender, Forest Research Lab, OSU, Corvallis 97331; or John Christie, Clatsop Community College, Astoria, OR 97103. SAF members in the Siskiyou Chapter should contact Ole Helgerson, Adaptive FIR.

# Of Interest

PROTECTING SEEDLINGS FROM DEER BROWSE - BIOLOGICAL AND COST EFFECTIVENESS

Foresters have used numerous techniques to prevent deer browse damage to planted seedlings of Douglas-fir. Most common are plastic mesh or paper barriers that protect the entire seedling or just its leader. Information collected by Greg Chandler and Doug Henry of the Medford District, BLM, indicates that although Vexar® tubes, netting, and paper budcaps are equally effective in preventing deer browsing, their cost of installation and maintenance vary widely (Table 1). In this study, installed on seedlings planted in 1981, each seedling protection technique was laid out on a transect that contained 50 seedlings. The site was located on a 50-55 percent slope and received about three feet of snow during the following winter. The Vexar® tubes were 34 inches long, the black netting was rolled-over just above the top of the seedlings, and the budcaps were made of 5 1/2 by 8 1/2 inch pieces of Rite-in-the-rain paper firmly stapled around the seedling.

Additional costs come from maintenance. In this study, 30 to 40 percent of the Vexar® tubes required straightening or replacement of lath stakes after being deformed by moving snowpack, and many steel twist ties had rusted and broken after one year. Vexar® tubes also must often be removed from seedlings to avoid girdling. With the netting, one-sixth of seedlings had grown out of the netting, and the netting had fallen off another one-sixth. In addition to replacing netting on these trees, another 21 percent will require maintenance to free leaders from the netting.

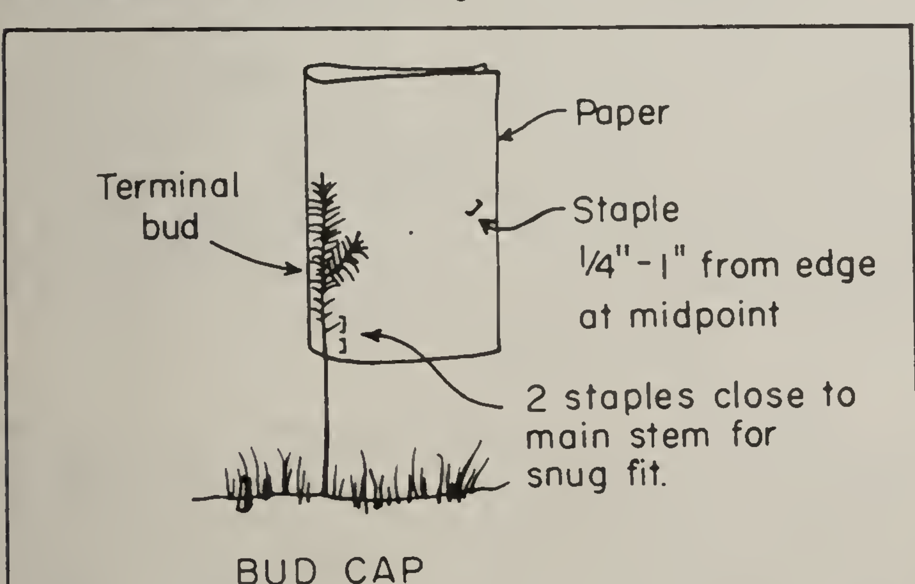


Figure 1. Attachment diagram for paper budcap.

Table 1. Performance of anti-deer browse treatments after one growing season.

| Treatment | Seedling mortality (%) | Browsed leaders (%) | Deformed seedlings (%) | Installation cost per tree[1] (1982 $) | Estimated relative maintenance cost[2] |
|---|---|---|---|---|---|
| Vexar tubing 34" | 0 | 0 | 3 | 0.236 | 1-3x |
| Black netting | 5 | 0 | 95 laterals 21 terminals | 0.045 | 1-2x |
| Paper budcaps | 5 | 0 | 0 | 0.060 | 1x |
| Control | 0 | 50 | --- | --- | --- |

[1]Cost of materials plus labor.

[2]Expressed as multiples of budcap application cost.

As for the budcaps, all remained attached to the seedlings, but the seedlings grew out of them after one season. Thus to be effective, the caps will require annual renewal until the seedlings grow beyond the range of deer browse.

So which treatment appears to be the most cost effective? The Vexar® tubes caused no mortality but had an installation cost four to five times that of the netting or budcaps and will require annual maintenance in areas susceptible to creeping snowpack.

Given a strong likelihood of no differences in first year survival between treatments, an intuitive assessment indicates that budcaps could be annually applied four and perhaps five times and cost less than tubes (installation plus maintenance costs) if rotation ages remain unchanged. Although netting appears to have the lowest initial cost, it also requires extra maintenance to replace netting and to untangle seedlings. Thus, budcaps appear to be the best alternative when they are applied firmly to the seedling to avoid being blown off.

O. H.

EVEN RESEARCHERS HAVE 20/20 HINDSIGHT

Recently I examined survival results from all Adaptive FIR research sites that have been planted with conifer seedlings. It soon became very apparent that on those sites where survival fell below 70 percent, competition from other vegetation was the major cause of mortality (Table 1). The only exception was on site 16 where a fungal infection built-up inside the budcaps during late spring while the seedlings were under a heavy snowpack. However, on those sites where adequate site preparation had been achieved or where re-emerging vegetation had been eliminated by supplementary treatments following planting, survival consistently remained above 80 percent.

Even though these 16 sites are considered "hard-to-regenerate," we probably could have obtained 80 percent survival or better on all of them had we been more aggressive in controlling competing vegetation.

This review reinforces our knowledge that the elimination of competing vegetation is a prerequisite to successful artificial regeneration in southwest Oregon. Unfortunately, we occasionally fail to make use of this information. We should not, however, lose sight of the fact that in those environments where soil moisture is the primary limiting factor, newly planted seedlings do

Table 1. Precent survival on 16 Adaptive FIR research plots located throughout southwest Oregon.

| Study site | Years of observation | Highest survival (%) | Cause of mortality |
|---|---|---|---|
| 1 | 3 | 86 | |
| 2 | 2 | 99 | |
| 3 | 2 | 98 | |
| 4 | 2 | 94 | |
| 5 | 2 | 87 | |
| 6 | 2 | 67 | Grass competition |
| 7 | 2 | 58 | Brush competition |
| 8 | 2 | 53 | Brush and forb competition |
| 9 | 2 | 48 | Grass competition |
| 10 | 2 | 47 | Brush competition |
| 11 | 1 | 100 | |
| 12 | 1 | 99 | |
| 13 | 1 | 95 | |
| 14 | 1 | 95 | |
| 15 | 1 | 84 | |
| 16 | 1 | 50 | Fungal infection |

not have a competitive advantage and must be relatively free of associated vegetation until their root systems have become adequately developed. How long this will take, of course, depends upon individual site conditions, but in southwest Oregon the first two years are certainly critical.

S. H.

## SKYLINE DEFLECTION: HOW MUCH IS ENOUGH?

It is a well established principle that adequate deflection is necessary for skyline cable systems. Depending on ground configurations, less than about 5-6 percent deflection can often cause log loads and carriages to drag on the ground, lower payload capabilities and decrease production efficiency. Virtually everyone that works with this type of harvesting system understands that as deflection increases so does the payload carrying capacity of a given diameter wire rope. "Good deflection" has come to be accepted as synonymous with a successful skyline cutting unit.

It may seem sacrilegious, therefore, to suggest that there could be such a thing as too much deflection, but observations by logging engineers and silviculturists over a period of years have led to this conclusion. This situation can occur in prescriptions for partial cutting when reducing logging damage to the residual stand is of primary importance. Minimizing the width of skyline corridors can help to keep the residual timber stand in good condition. Controlling skyline deflection can help achieve this objective.

Deflection, of course, is the sag in the skyline. It is formally defined as the vertical distance between the chord and the skyline. It is usually measured at midspan and expressed as a percentage of the span length (Figure 1).

If we slice through this diagram vertically at midspan and view it from the perspective of looking straight down the chord from the headspar support point, we see a projection of the vertical deflection distance as shown in Figure 2.

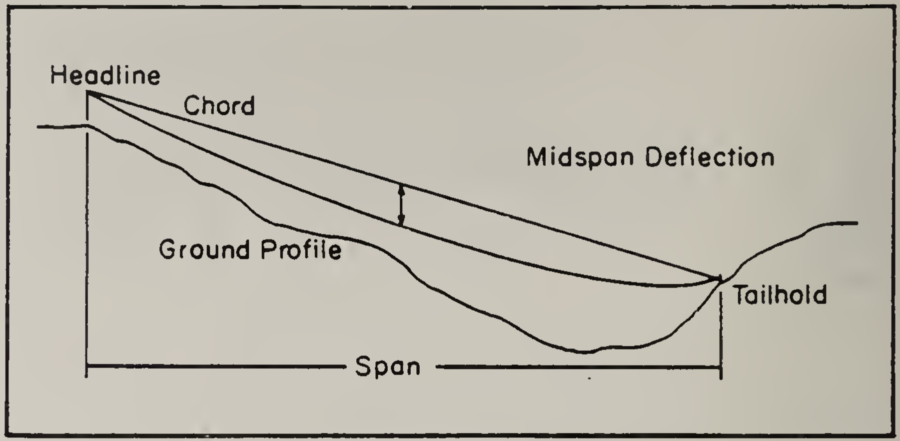


Figure 1. Skyline profile.

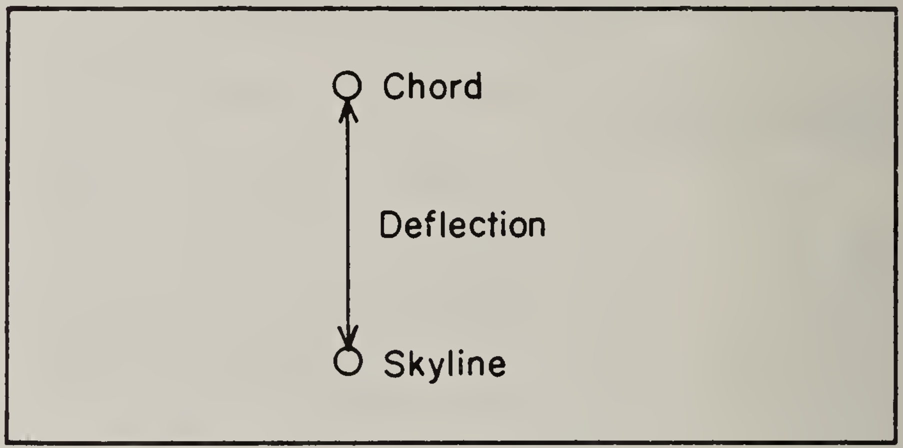


Figure 2. Cross section of skyline profile.

In the lateral yarding phase of log movement, as tension is developed in the drop line and the skyline, the vertical deflection is translated to lateral skyline deflection. An overhead or plan view of this situation is shown in Figure 3.

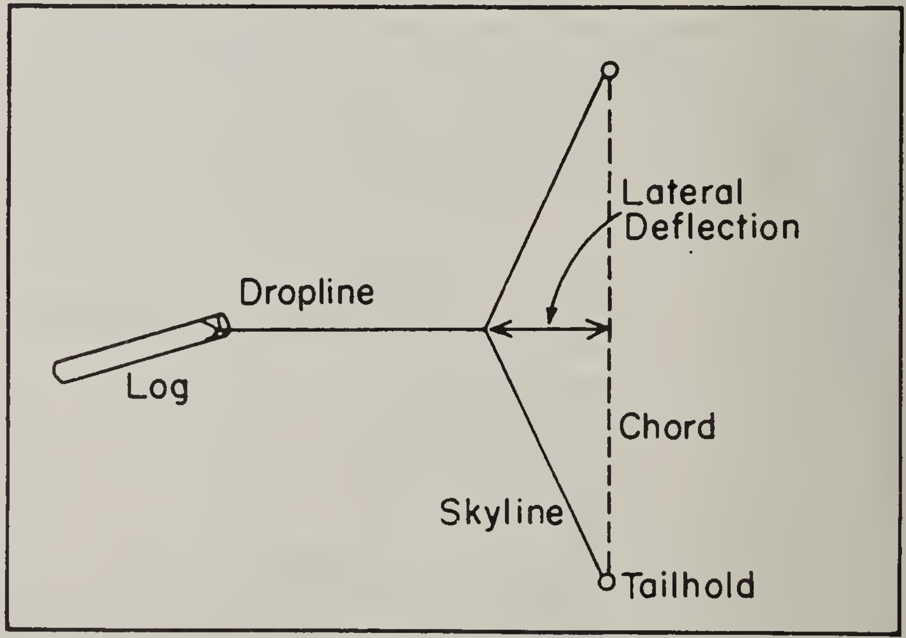


Figure 3. Plan view of the skyline profile during lateral yarding.

While it does not necessarily have to be so, the amount of lateral deflection in many operations is approximately the same or greater than the vertical deflection that existed prior to lateral yarding. Just as with a skyline's ability to support vertical loads, the capacity for lateral loads increases as lateral deflection increases. During lateral inhaul, a yarder engineer will often allow the skyline to deflect toward

the load until the log being yarded begins to move toward the corridor. Because log movement is made easier by increasing lateral deflection, the natural tendency is for the yarder engineer to let the skyline deflect to the side; initially by the vertical deflection distance available and, if this does not prove to be adequate to break the log loose from its bed, by then increasing the skyline length and lateral deflection. If we use the cross sectional view of a skyline profile developed in Figure 2 to help understand what is occurring here, we see that the skyline is rotating on an axis represented by the chord (Figure 4).

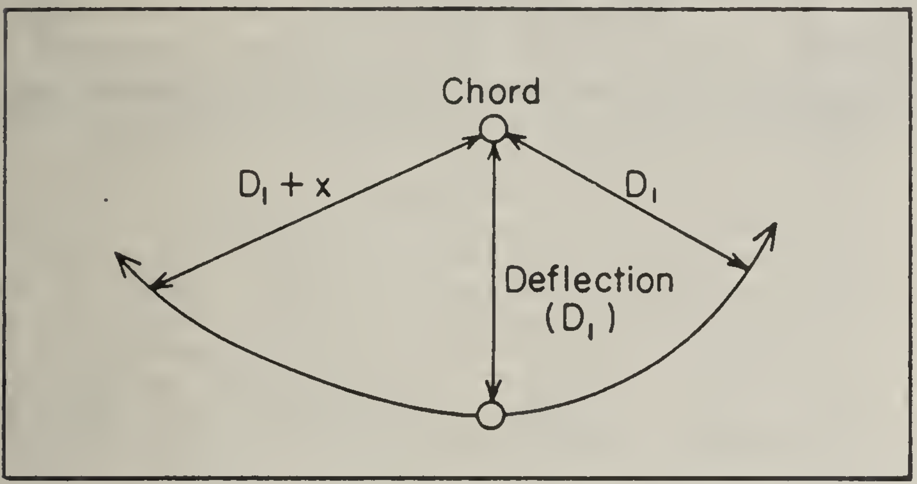


Figure 4. Cross section of skyline profile during lateral yarding.

The greater the vertical deflection available in any given yarding situation, the greater the lateral deflection that can be expected. As lateral deflection increases, the width of the skyline corridor and the likelihood of damage to more residual trees also increases. Depending on tree size in the residual stand, damage can range from bark removal and top damage on large trees to complete destruction of smaller trees. Skyline corridors with fairly narrow end areas but extremely wide central bulges are often the result of a lack of control over lateral excursion.

As was previously indicated, this does not have to occur. Lateral movement of the skyline can be controlled by the rigging slinger and the yarder engineer. Some lateral skyline movement is absolutely necessary if lateral yarding is to be efficient and safe. There is, however, no real need to increase the lateral excursion of the skyline until after the safe working load of that line has been approached. The same principle holds true for vertical deflection and moving logs up (or down) the skyline corridor during inhaul. Enough deflection is needed to carry the maximum expected payload at the safe working load of the line and to keep strain on the lines and equipment at an acceptable level. Additional deflection to decrease skyline tension or increase payload size above what can realistically be hooked on a turn is superfluous and, as has been described in this report, encourages greater lateral deflection, wider skyline corridors, and increased stand damage.

J. M.

WATERBARS: CAN WE MAKE THEM MORE EFFECTIVE?

Blakemore Thomas, Watershed Management Department, Humboldt State University, recently completed a thesis entitled An Evaluation of Waterbar Effectiveness in the Coast Ranges of Northern California, which documented characteristics of failed waterbars. Four types of failure were observed:

Type 1: Waterbar broken by raindrop impact or overland flow; water moves freely down the trial.

Type 2: Water not sufficiently slowed or dispended at the waterbar outlet, resulting in a gully.

Type 3: Waterbar broken by animal traffic.

Type 4: Waterbar broken by vehicular traffic.

The last two failure types were not significantly associated with frequency of failure or amounts of rill or gully erosion. Methods of construction affected the Type 1 and Type 2 failures. Forty-seven percent of the waterbars built with an angle < 30° (measured from the perpendicular of the skid trail centerline) had a Type 1 failure, while only 6 percent of the waterbars built with an angle $\geq$ 30° failed. Waterbars built with no outlet for runoff had a 66 percent Type 1 failure rate, but those possessing a clean outlet had only a 7 percent failure rate. Sixty percent of waterbars built in through cut skid trail sections also had Type 1 failures.

Distance between waterbars, topographic position, and terrain slope strongly influenced Type 2 failures. Skid trails built within 100 feet of a stream channel had higher incidents of Type 2 failure. Mean erosion per waterbar for Type 2 failures was 2.6 cubic yards and for Type 1 failures was 0.9 cubic yards. Both types of failure and related erosion increased significantly on slopes greater than 50 percent.

Thomas recommends that Type 1 failures can be kept to a very low percentage if waterbars are constructed with angles between 30° to 60°, clear outlets, and heights of at least 12 inches. Type 2 failures can be reduced by better spacing and location of waterbars. Because most Type 1 and 2 failures occurred during the first winter and did not significantly increase over the next ten years, he concludes that land managers can get a good estimate of waterbar effectiveness and maintenance needs after the first year. Thomas' thesis is available from the Humboldt State University Library, Arcata, CA 95521.

Carl Yee
Humboldt State University

# Recent Publications

For copies of these publications, mail your requests to the indicated address:

1 FIR
1301 Maple Grove Drive
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2 Oregon State University Bookstore
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AVERAGE DRY-SEASON PRECIPITATION IN SOUTHWEST OREGON, MAY THROUGH SEPTEMBER, by D. H. McNabb, H. A. Froehlich, and F. Gaweda. 1982. Extension Service EM 8226, Oregon State University, Corvallis, OR 97331. 7 p. + 1 map. Data collected from 79 precipitation stations (National Weather Service, Oregon Water Resources Department, USDA Forest Service, and USDI (Geological Survey)) were used to construct these two new precipitation maps for a five county southwest Oregon area. The data indicate that average annual precipitation is higher than previously reported, particularly in the western Siskiyou Mountains. Precipitation is strongly influenced by elevation over much of the region, with the region subdivided into smaller zones to account for rainshadows and similar local effects of mountainous terrain. Dry season precipitation during the months of May to September averages about one seventh of average annual precipitation across the sampling areas, and is lowest in the interior valleys. Of these, the Rogue Valley receives approximately two thirds the precipitation during the dry season as does the Umpqua Valley. The variation in dry-season precipitation, coupled with the constancy of potential evapotranspiration, makes this map useful for predicting the region's dry season climate. Each map costs $1.25 plus 25¢ for postage and handling.

1

OREGON WEED CONTROL HANDBOOK, compiled by R. D. William. 1983. Extension Service, Oregon State University, Corvallis, OR. 148 p. This version is little changed from the 1982 edition. It remains a very useful compendium of the properties and uses of herbicides and other agrichemicals. Changes of interest to foresters include updated information on triclopyr and application times. Also of interest are tables illustrating herbicide effectiveness on numerous non-woody weeds found in eastern and western Oregon. $15.

2

HANDBOOK OF WEED AND INSECT CONTROL CHEMICALS FOR FOREST RESOURCE MANAGERS, by M. Newton and F. B. Knight. 1981. Timber Press, Beaverton, OR. 213 p. This pocket sized handbook provides a comprehensive guide to controlling forest weeds and insects with chemicals in forest ecosystems across the United States. The chapter on forest vegetation management includes basics of weed ecology, chemical properties, biological properties, and formulations of herbicides, application methodology and prescriptions. Among the information in the chapter on forest insect management, insects are classified by the type of damage they produce, specific problem situations are identified, and the chemical properties and the application of various insecticides are discussed. Chapters are also devoted to application technology and risks and care in handling pesticides. The appendix contains information by chemical class on the management of chemical poisoning. This publication should be of considerable use to anyone interested in pest management in forest ecosystems.

2

AVERAGE ANNUAL PRECIPITATION, 1960-1980, IN SOUTHWEST OREGON, by D. H. McNabb, H. A. Froehlich, and F. Gaweda. 1982. Extension Service EM 8220 Oregon State University, Corvallis, OR 97331. 8 p. + 1 map.



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# FIR Report

## SUMMER 1983

VOL. 5 NO. 2

"FIR REPORT" is a quarterly newsletter containing information of interest to individuals concerned with forest management in southwest Oregon. It is mailed free on request. Requests should be sent to: FIR REPORT, 1301 Maple Grove Drive, Medford, Oregon 97501.

FIR REPORT communicates recent technological advances and research pertinent to southwest Oregon, and alerts area natural resource specialists to upcoming educational events. Comments and suggestions concerning the content of "FIR REPORT" are welcome and should be sent to the Medford address.

The Southwest Oregon Forestry Intensified Research Program (FIR) is a joint effort between the School of Forestry at Oregon State University and the Pacific Northwest Forest and Range Experiment Station of the U.S.D.A. Forest Service. It is designed to assist region foresters and other specialists in solving complex biological and management problems unique to southwest Oregon. FIR specialists organize, coordinate, and conduct educational programs and research projects specifically tailored to meet regional needs.

Established in October, 1978, the FIR Program is supported by Oregon State University, the Bureau of Land Management, U.S.D.A. Forest Service, O & C Counties, and southwest Oregon timber industries. It represents a determined effort by the southwest Oregon forestry community and county governments to find practical solutions to important forest management problems.

For the FIR Staff

Ole T. Helgerson

Ole T. Helgerson
Silviculture Specialist

## Inside



OREGON STATE UNIVERSITY
EXTENSION SERVICE

# FIR Specialists

OLE HELGERSON, Silviculture

STEVE HOBBS, Reforestation

JOHN MANN, Harvesting

DAVE McNABB, Watershed

STEVE TESCH, Silviculture


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# Current Research

# Fundamental FIR

## WIND PATTERNS IN A CLEARCUT AND AN ADJACENT SHELTERWOOD STAND

Foresters have long argued the effects that clearcut and shelterwood harvesting have on the climate near the ground. In addition to providing a radiation barrier for shade or frost protection, shelterwood harvesting has been felt to also have an effect on patterns of air flow. Because air movement has a strong effect on the temperature and water relations of conifer seedlings, this study was designed to look for differences in air flow patterns between snelterwood and clearcut areas to help develop greater insight into causes of seedling mortality.

The study was conducted in a south-facing clearcut (7 ha) and a shelterwood stand (12 ha) which adjoined on contour. The paired sites were inclined at slopes of 27 to 36 percent, and were located midway between the ridgetop and canyon bottom. Windspeed was measured at 1.5 m above the ground in the center of each site, and its average recorded every 30 minutes.

The shelterwood held Douglas-fir and grand fir which averaged 48 m in height, with a basal area of 24 $m^2$/ha (105 $ft^2$/ac)--about one-third of the original stand density. The shelterwood had only scattered thistles in the understory and was bounded on its other side by another clearcut unit. The clearcut study unit contained sparsely scattered five to ten year old seedlings, a result of previously unsuccessful reforestation efforts.

The windspeed data revealed that the clearcut and shelterwood stands differed in wind velocity and frequency of change as indicated by autocorrelation analysis. Nighttime air flows, probably caused by downslope air drainage, were common in the clearcut but did not appear in the shelterwood data. Instead, air flow in the shelterwood appeared to change over longer time periods, i.e., at a lower frequency. Surprisingly, daytime maximum windspeeds were always greater in the shelterwood, perhaps because the standing trees confined the incoming airflow into a smaller space.

The magnitude of variation in windspeed was also greater in the shelterwood stand to the extent that computed intensities of turbulence were consistently twice as large as in the clearcut. This implies that convective heat and moisture exchanges could be about four times greater in the shelterwood.

Dick Holbo
Forest Engineering, OSU

## VARIATION IN SUNLIGHT UNDER SHELTERWOOD CANOPIES

Foresters and ecologists have often noted that while solar radiation reaching the forest floor is roughly related to stand basal area, the pattern of sunflecks and shadows, which determine a seedling's microclimate, can often be quite variable. Most models of solar radiation beneath a canopy follow Beer's law which can be good at predicting average conditions. Such a relationship between stand basal area and the mean daily transmission of solar radiation through three shelterwood canopies in southwest Oregon is shown in Figure 1. Unfortunately, this relationship does not describe the ecologically important variability in light intensity.

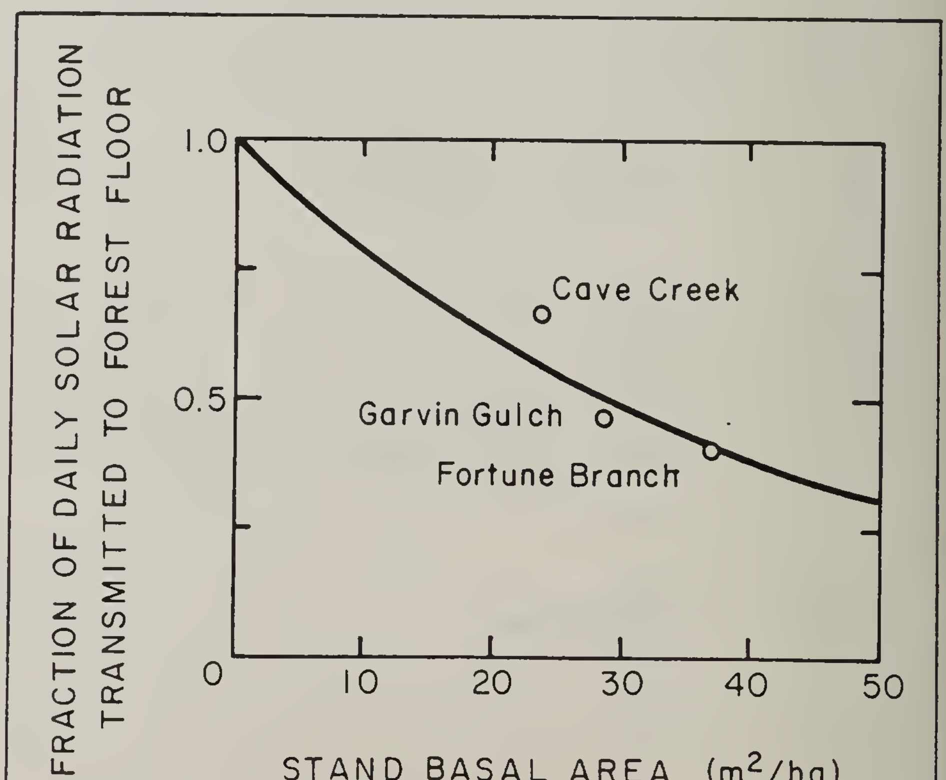



Figure 1. Transmitted solar radiation versus stand basal area for three shelterwood canopies.

The general problem of expressing this variability is seen in Figure 2. For these three canopies of different basal areas, we see that the range of sunlight at a point under each canopy is the same, varying from full sun to nearly full shade. Canopy density appears, however, to affect the duration and rapidity of change from full sun to full shade. How can this variability be described?

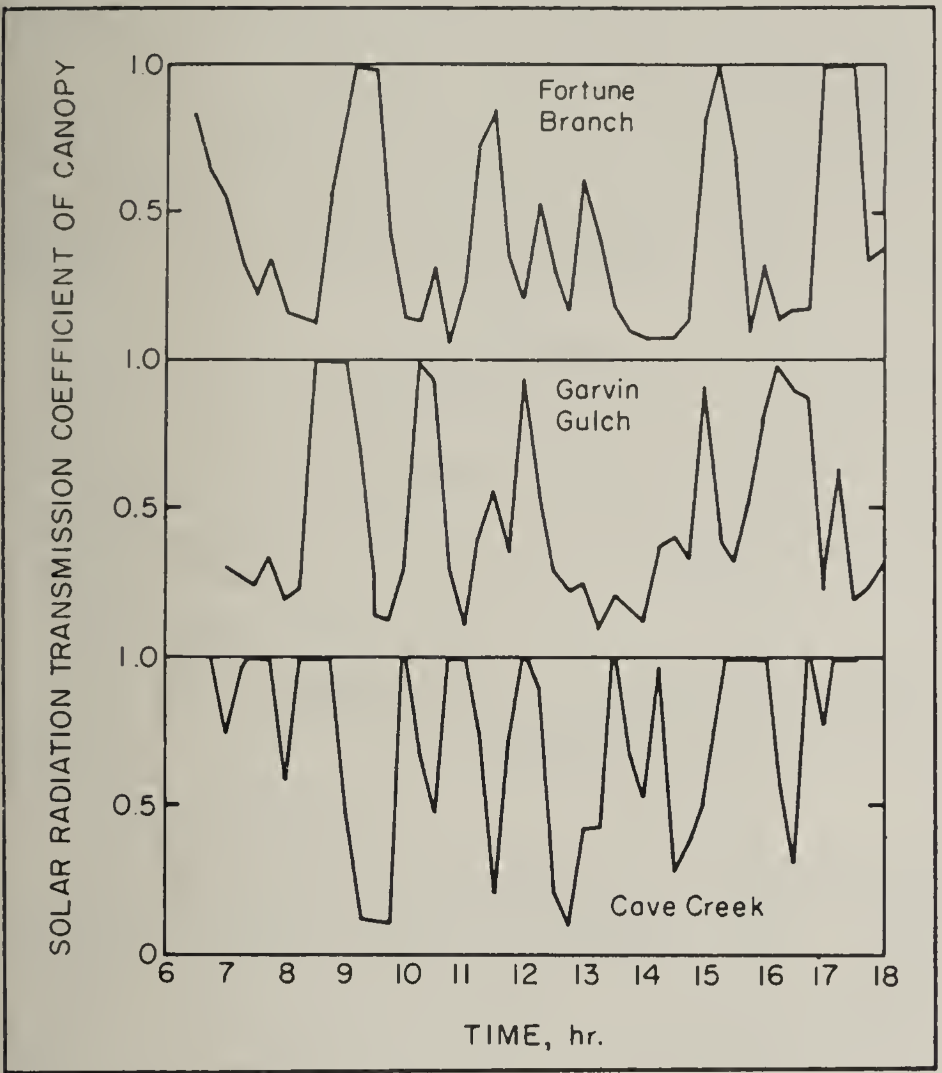



Figure 2. Daytime fluctuations of solar radiation under three shelterwood canopies.

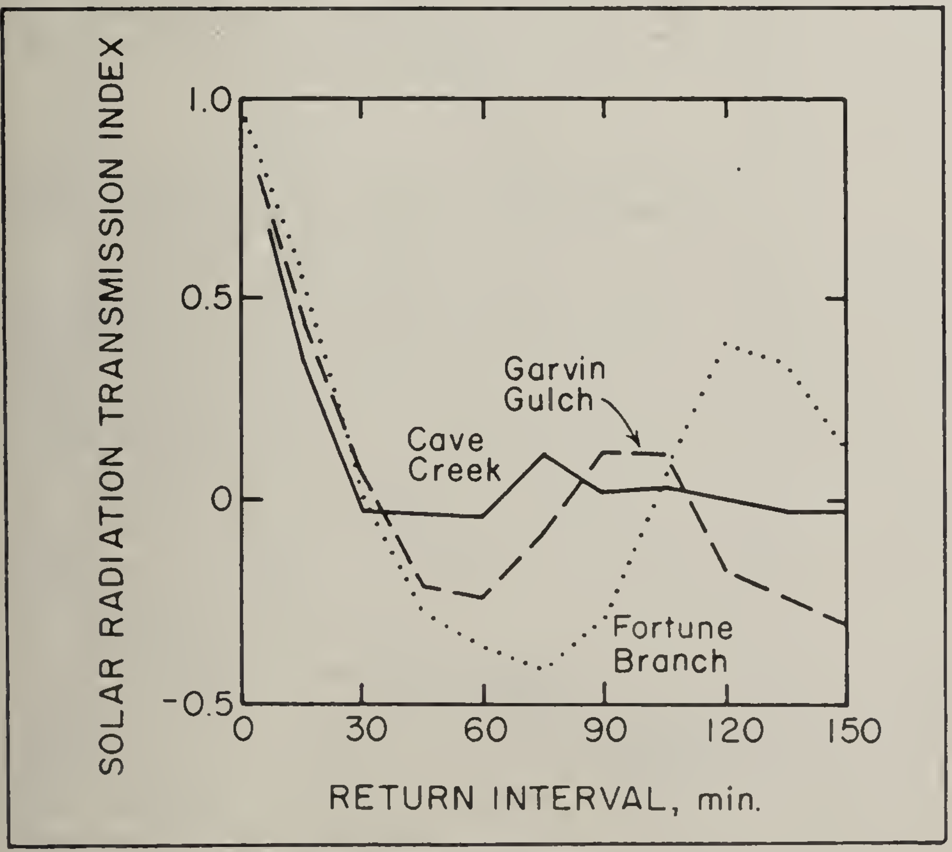



Figure 3. Return interval or periodicity of fluctuations of solar radiation beneath three shelterwood canopies.

One approach is to use a mathematical technique known as autocorrelation analysis. This method describes the variation in a variable over time by correlating pairs of values of the variable at increasingly greater time separations. This technique can describe the length of time or return interval for which a given level of the variable, in this case, relative light intensity, occurs.

The effect of these three different shelterwood canopies on the periodicity and duration of sunflecks is illustrated in Figure 3. The vertical axis in this figure is a normalized index based on the duration of light transmission. The zero level represents the average trnamission coefficient from the plots in Figure 2. Note that the shelterwood stand with the greatest basal area (Fortune Branch) produces the lowest minima, indicating that relative to its mean, it has the longest lasting periods of shade. Thus, a seedling microsite under this shelterwood, in addition to receiving less solar energy on the average (Figure 1), would be exposed to shade for longer periods of time each day. The index in Figure 3 would be useful in seeing whether two stands with the same average levels of canopy cover and solar radiation have different periodicities of light and shadow. This may help explain why survival and seedling growth may differ between two otherwise similar shelterwood stands. Although the data in this study were collected electronically, it may also be possible to acquire suitable data photographically or by other means.

Dick Holbo
Forest Engineering, OSU

## HORMONE RESEARCH AND DOUGLAS-FIR CONE PRODUCTION

Irregular production of cones in Douglas-fir often complicates the forester's job of reforesting cutover lands with seedlings from the proper seed source. Plant hormones have long been implicated in the physiological control mechanism which determines when cones are initiated. The gibberellins, a class of hormones associated with flowering in other plants, have been under investigation for several years, but the cytokinins, which are usually associated with cell division processes, have been largely ignored. With the development of new techniques which utilize immune reactions in laboratory animals to measure very small quantities of plant hormones, cytokinin levels can now be measured in shoots of Douglas-fir.

Recent measurements indicate that differences exist in the cytokinin contents of male, female, and vegetative shoots. These results suggest the cytokinins may play a role in inducing cones. Furthermore, cytokinin contents appear to differ between undifferentiated shoots which subsequently produce cones and those which produce only vegetative shoots. The precise identification of specific cytokinins is the subject of a current experiment. Preliminary results indicate that zeatin riboside (one of the cytokinins) is common in vegetative shoots but exists only in small quantities in shoots which later produce cones.

This research could lead to methods for increasing cone production or for predicting years when cone set will be low.

Joe Zaerr
Forest Science, OSU

## 2,4-D HERBICIDE DAMAGE DETECTED FROM GROUND BASED SPECTRAL MEASUREMENTS

Remote sensing is an effective and economical method for monitoring growth patterns of vegetation, diseases, plant mortality and insect infestation. This technique could also be very useful in monitoring herbicide effectiveness in forest vegetation management, particularly in remote areas. Few studies, however, have looked at changes in the spectral response of plants treated with herbicide. Such knowledge is necessary if remote sensing techniques are to be applied to forest vegetation management.

This study was initiated to assess the potential of ground-based spectral measurements, in the visible and near-infrared, to detect biological damage caused by the aerial application of 2,4-dichlorophenoxy acetic acid (2,4-D) herbicide for forest vegetation management. Three dominant southwestern Oregon brush species were studied in the field during the summer of 1981, four months aver 2,4-D treatment. The plants' basic spectral characteristics, damage gradients, contrasts in reflectance data, and associations with seasonal plant moisture stress and individual canopy cover were investigated.

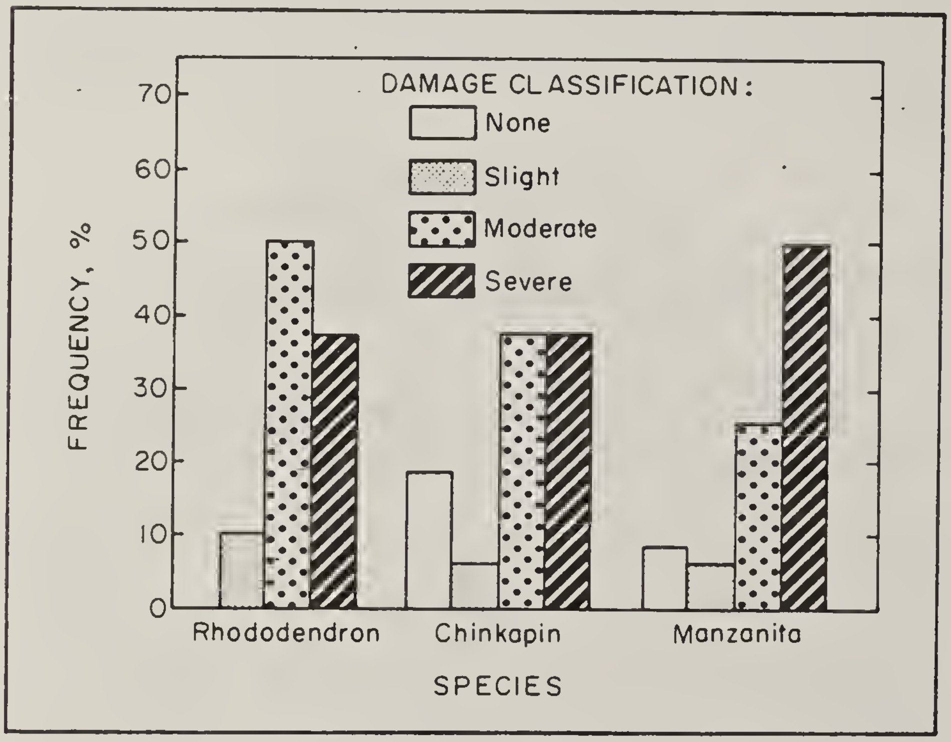
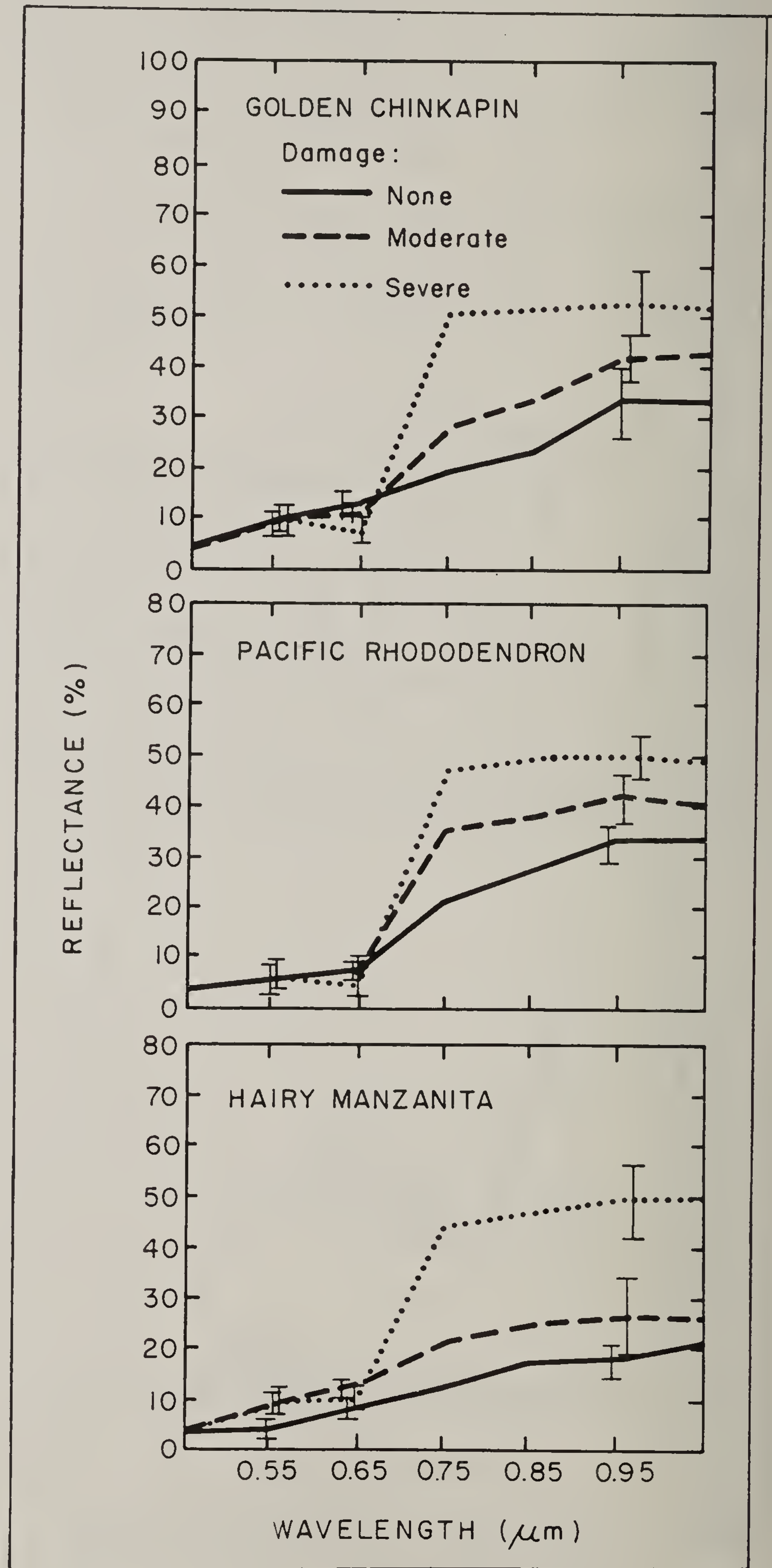



Figure 1. Observed brush damage by species four months after the aerial application of 2,4-D herbicide. Damage classification is based on the following criteria: (1) healthy plants with no evidence of herbicide damage; (2) slightly damaged plants showing some sign of deformed, or chlorotic and/or necrotic tissue, but less than 25 percent of the foliage so damaged; (3) moderately damaged plants exhibiting 25 to 75 percent foliage discoloration and some stem damage; (4) severely damaged plants with 75 to 100 percent foliage and stem kill.

Figure 2. Spectral reflectance curves, $\pm$ standard deviation, contrasting golden chinkapin, Pacific rhododendron, and hairy manzanita by damage level four months after treatment with 2,4-D herbicide.

The study site was an approximately 10-year-old clearcut located in the Cow Creek reforestation unit (T32S, R10W, Sec. 2, Willamette Meridian) on the Siskiyou National Forest in southwestern Oregon. Portions of the area had been aerially sprayed with 2,4-D at 3.4 kg acid equivalent per hectare in May 1981. The treatment plots were situated on an east aspect with a 40 percent slope. Spectral reflectance of the foliage differed among species in the treated and untreated (control plots), with the largest contrast found in the near-infrared portion of the spectrum. Plants in the



unsprayed control area displayed typical reflectance curves associated with healthy vegetation, i.e., absorption in the blue and red wavebands and high reflectance in the near-infrared. Those in the sprayed plot displayed a slight change in the visible region, notably an increase in red reflectance. More obvious was a relatively large decrease in near-infrared reflectance, suggestive of changes in leaf cellular arrangement, cell wall/air interfaces, and leaf orientation.

Ocular estimates of damage based on ground observations revealed variation within and between species in the sprayed plot. Hairy manzanita displayed the most severe damage. Pacific rhododendron and golden chinkapin were moderately to severely damaged in most cases. Some individuals of all three species showed little effect (Figure 1).

Spectral measurements were grouped for individual plants of each species by damage level. Mean reflectance values were used from the control plot for contrasting healthy versus moderately to severely damaged plants across a portion of the spectrum. The curves illustrate reflectance by wavelengths for three levels of foliar damage -- none, moderate, or severe (Figure 2).

The use of spectral responses has the potential to provide better estimates of brush damage than ocular estimation. This is because foliar damage from herbicide that is not visible to the eye is detected easily with infrared sensors.

The current use of infrared detection technology extends from aircraft to satellites which can be fitted with photographic or electronic sensors. For applied forestry use, however, my personal experience suggests strongly that images taken from light aircraft with handheld cameras and commercially available infrared film will provide more accurate estimates of herbicide effectiveness than currently used ground based surveys, and at a far lower cost.

Richard W. McCreight
Forest Science, OSU

## WATER AVAILABILITY IN SKELETAL SOILS

Water is often the primary factor which limits reforestation success in southern Oregon. Reforestation management should benefit if better estimates of available water could be obtained. Skeletal soils constitute nearly two-thirds of the soil on land withdrawn because of reforestation problems. Measuring available soil water on these soils has also proven to be particularly difficult in the past. For these reasons, I decided to assess soil water availability in relation to physical factors on a variety of skeletal soils in southwest Oregon for my Master's thesis.

To measure water availability, it was first necessary to accurately estimate bulk density of soils taken from irregularly shaped holes over a range of slopes. Thus a sampler was designed to sample bulk density and rock fragment content under these conditions. Next, physical properties and available water were measured for soils at 40 locations in southwest Oregon. The soils were derived from nine parent materials including granite, basalt, andesite, ash, serpentine and metasediments. Samples were taken from the top 25 cm, an area considered to be the root zone for newly planted seedlings.

The variability of these soils was great enough so that the physical soil characteristics were unique for each site and could not be transferred from soil to soil. Although the soils averaged 25 percent rock fragment (>2mm diameter) by volume, the bulk density of the fine soil portion averaged 0.94, quite suitable for root growth. On the whole soil basis, organic matter averaged six percent, but excluding rock fragments, it averaged 12 percent. This high concentration not only improves the nutrient status of the soil but also helps to maintain low bulk densities.

The presence of rock fragments in these soils has been felt to considerably reduce soil water availability. This effect is offset, however, by the discovery that the rock fragments are porous enough to provide over 15 percent of the total available water. Available water capacity was defined as the difference between field capacity and the seasonal low. This was estimated from studies of soil wetting at all 40 locations.

At 19 sites, field capacity was measured on naturally wetted soils in March. At the remaining locations, the soil was thoroughly saturated in situ during the summer and sampled two days later. The water content at field capacity for the soils measured in March averaged 27 percent and was 24 percent for the soils tested during the summer. Water potentials at field capacity measured in March averaged -7 kPa (-.07 bars), with some soils having values as low as -2 kPa (-.02 bars). The rock fragments appear to have a positive effect in that the rock fragments and layering appear to lower water potentials and elevate water contents at field capacity.

Regression equations were also developed to predict total available water from soil characteristics. These models, when used in conjunction with other field information, can provide a reasonable estimate if direct measurement is not possible. These equations require, however, very specific information for each soil. Estimates of physical properties can be used but decrease the reliability of the answers. For these reasons, direct measurement of a soil's water characteristics is preferable.

In addition to soil characteristics, water supply to a seedling depends on such factors as precipitation inputs, rates of evapotranspiration, competing vegetation and root growth. More accurate knowledge of soil water availability should, however, help greatly in leading to more site specific reforestation practices. Managers will be better able to decide when such techniques as artificial shade, shelterwood harvesting or more intense site control techniques may be necessary.

Copies of the Master's Thesis "Soil Physical Properties and Available Water Capacity of Southwest Oregon Forest Soils" are available from the Department of Soil Science, OSU, Corvallis, OR 97331.

Alan Flint
Soil Science, OSU

# Adaptive FIR

## ALTERNATIVE METHODS OF BRUSH CONTROL STUDY

A new study designed to explore alternative methods of brush control has been initiated by members of the Adaptive FIR staff in cooperation with the Medford District of the Bureau of Land Management. The study will compare several handslashing treatments with one or more herbicide prescriptions and untreated controls. The sequence of slashing treatments may be scheduled to coincide with different stages of phenological development or levels of plant moisture stress. Emphasis will be placed on units where post-planting maintenance is required to control resprouting sclerophyll brush. Study sites will have been clearcut and broadcast burned prior to planting. Treatments will probably be installed on units where brush resprouts are from one to three years old. Seedling survival and growth, and resprout growth will be measured over a period of several years. Estimates of treatment costs will also be made.

Over the next three months the study plan will be developed and study sites located. As the study progresses, periodic summaries will appear in the FIR REPORT.

S. H.

## REGENERATION POTENTIAL OF WITHDRAWN LANDS

As reported in past issues of the FIR REPORT (4(1):4; 4(4):4), this study is designed to better define the potential for artificial reforestation of lands withdrawn from the allowable cut land base in cooperation with the Medford District, BLM. The basic steps of the study are to classify withdrawn lands by their site characteristics, select and prepare sample sites that represent the range of withdrawn lands, plant Douglas-fir seedlings to serve as bioindicators of site quality, and then to look for relationships between Douglas-fir survival and growth, and site characteristics.

MEANS FOR SITE VARIABLES FOR LOW INTENSITY AND LIMITED USE LANDS

| Class | No Sites | Average Slope (%) | Average Elev (Feet) | Primary Aspect (Deg) | Summer Precip (In) | Average Available Soil $H_2O$ (In)[2] | Summer Sunshine (Gram Cal) |
|---|---|---|---|---|---|---|---|
| Limited Mgmt | 1563 | 49 3 | 2544 | 96 & 264 | 5 5 | 3 9 | !31390 |
| Low Intensity Mgmt | 906 | 47.2 | 2825 | 98 & 262 | 5 0 | 3.9 | 132770 |

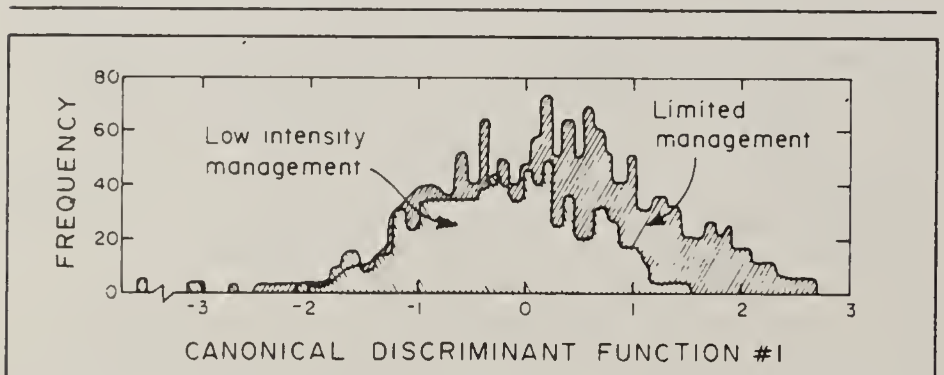



Figure 1. Comparison of two categories of withdrawn lands by selected site characteristics.

The withdrawn lands were originally split into two administrative categories. As a first step in classification, it was necessary to see if these lands truly differed. A technique called discriminant analysis was used to see if these two classes could be separated in terms of slope, aspect, elevation, precipitation, solar radiation and soil characteristics. The results indicated that the two administrative categories shared very similar characteristics (Figure 1). The horizontal axis is a composite variable based on the site variables.

Average aspect shows two values because a cosine function was used for the statistical analyses. Cosine functions are, however, difficult to visualize. A frequency plot (Figure 2) shows more clearly how the withdrawn lands lie with respect to aspect. Although most sites face southerly, many withdrawn lands have northerly aspects.

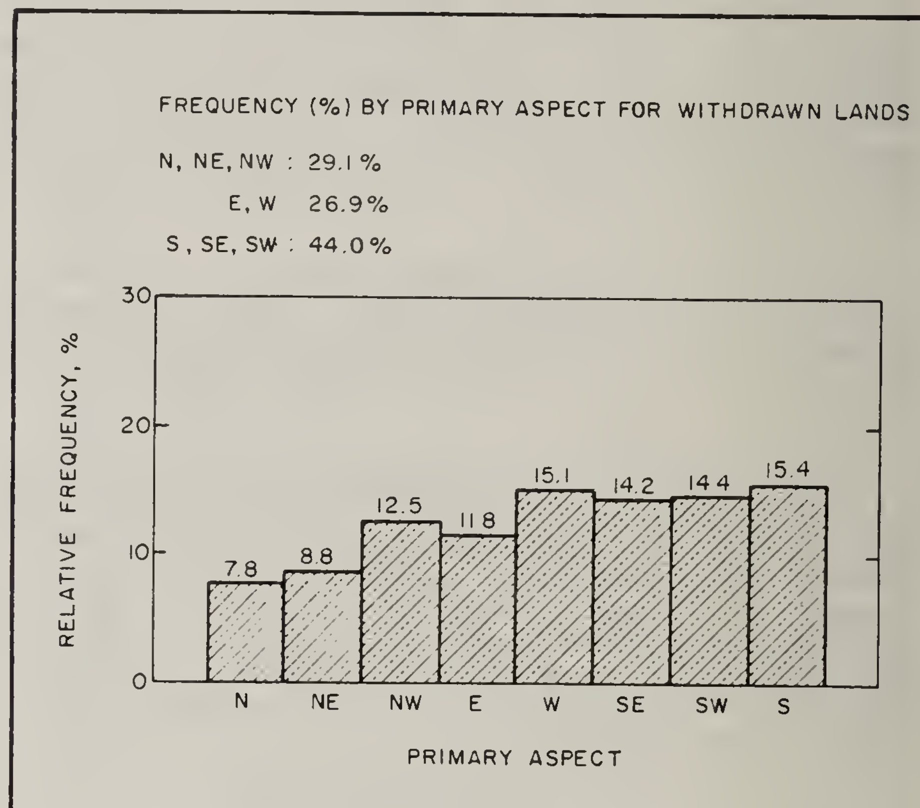



Figure 2. Frequency of withdrawn lands by primary aspect.

The next classification step was to identify major sources of environmental variation in the body of withdrawn lands. This was necessary to provide a strong foundation for selection of test sites by helping to ensure that the site characteristics with the greatest ranges would be covered in the sampling process. For example, if the withdrawn lands varied more in aspect than in elevation, then a sampling method based primarily on aspect could be expected to do a better job of covering the greatest range of site conditions.

A statistical technique called principal components analysis was used to see which site variables contributed the most to the overall variation found across the withdrawn lands. This technique revealed that variables associated with water supply and solar radiation accounted for 74 percent; elevation, 10 percent and slope 8 percent of the total variation. Also revealed was a strong correlation between aspect and solar radiation for this set of data.

These results were fortuitous. Solar radiation (as aspect) and water, aside from their statistical importance, have been associated with seedling survival in the study by Dieter Schöne reported in this issue.

The maximum amount of water available to a seedling is constrained by what the soil can hold at the onset of the growing season, plus additional precipitation during the growing season. Transpiration rates and heat loads in a seedling's environment are associated with solar radiation during the growing season. Thus these variables provided a realistic basis for subsequent sampling.

Plotting numbers of withdrawn sites by their summertime solar radiation and water characteristics revealed that most sites have high radiation loads (SW, SE, S aspects) and are low in water (Figure 3). The distribution of radiation loads mirrors that of aspect in Figure 2. The distribution across total available water, however, ranges from dry sites with shallow rocky soils to sites with deep, good soils and high levels of precipitation.

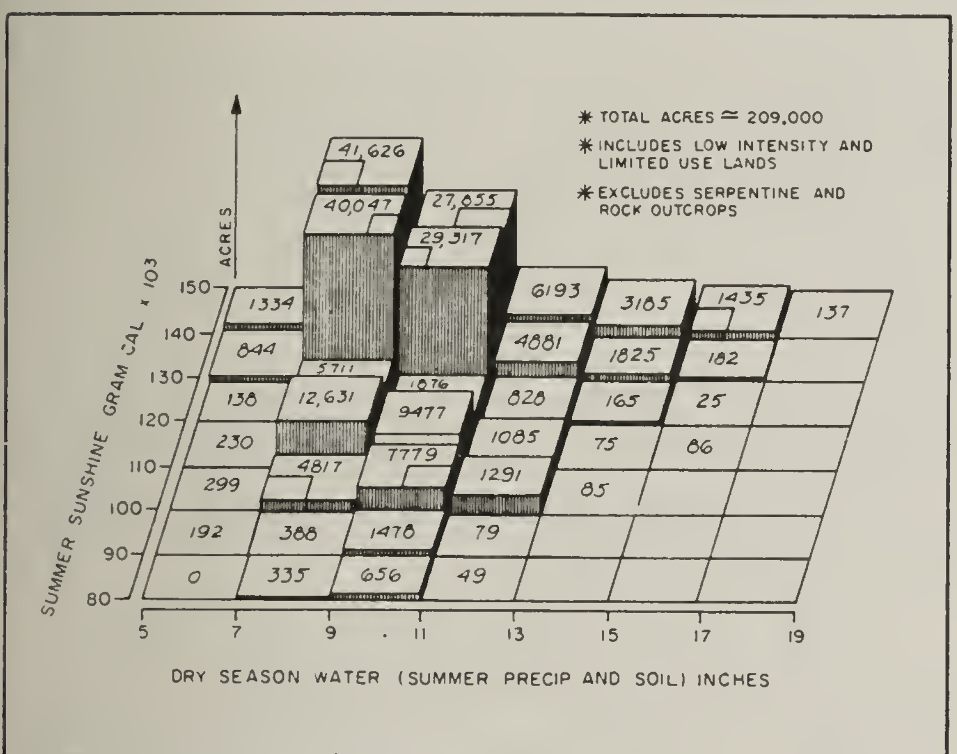



Figure 3. Acreage of withdrawn lands by summer sunshine and water availability (May 1 - September 30).

Sampling the withdrawn lands on this radiation by water grid must meet several conditions. Most sites should be represented, sampling should be more intense where more sites occur, selected sites should be planted over several growing seasons, and estimates of experimental error are necessary. The sampling scheme that has been selected is to plant a minimum of six sites at each of the six shaded regions on the radiation by water grid. The test sites will be planted over several years to reduce the influence of uncommonly good or bad planting years. On suitable sites, ponderosa pine will also be planted.

This study is designed to provide an overall view from which to approach the reforestation problems of withdrawn lands. As such it will help to place other ongoing reforestation research in perspective and will help to define other areas where information is lacking. Survival results from this and other FIR studies indicate that good initial seedling survival can be achieved on certain types of withdrawn land. As more study sites are prepared and planted, stronger estimates of expected survival will become established across the full range of withdrawn lands.

O. H.

# Continuing Education

SEEDLING PHYSIOLOGY AND REFORESTATION SUCCESS

A one-day technical session will be held on Tuesday, October 18, during the SAF National Convention in Portland, Oregon. This Physiology Working Group Session includes overview and specific research reports on the relations between seedling physiology and reforestation success. The program will be split to cover stock quality and the response of planting stock to site conditions. More detailed discussions will be presented on tissue culture and vegetative propagation, seed, bareroot and container seedlings, matching species and stocktype to site, weed control and nutrition management. The proceedings of this session will be published. For more information contact: Mary L. Duryea, Department of Forest Science, OSU, Corvallis, OR 97331. Telephone (503) 753-9166.

UPCOMING ADAPTIVE FIR WORKSHOPS

Six workshops are being planned for fiscal year 1984. Workshop topics in approximate order of presentation are "Reforestation Research Advances in Southwest Oregon" (February 1984); "Minimizing Timber Harvesting Impacts" (Spring 1984); "Timber Harvesting Systems - Cable"; "Timber Harvesting Systems - Tractor"; "Forest Weed Control for Southwest Oregon"; and "Selecting Stands for Fertilization" (Fall 1984). More detailed information will be forthcoming in workshop flyers. For advance information contact: Elaine Morse, Adaptive FIR.

# Of Interest

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SECOND PRINTING

A second printing of the Proceedings of the Reforestation of Skeletal Soils Workshop has recently been completed and copies are once again available for purchase at $7.50 a copy. The proceedings contain 19 papers which address various aspects of the reforestation of skeletal soils with particular emphasis on southwest Oregon. Topics range from "The nature of skeletal soils in steep terrain" to "Site preparation strategies for skeletal soils" and "Mycorrhizal inoculation." Checks or purchase orders should be made payable to: OSU SCHOOL OF FORESTRY, for $7.50 per copy (US dollars) and sent to:

Workshop Proceedings
FIR
1301 Maple Grove Drive
Medford, OR 97501

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## PROBABILITY, SITE QUALITY, AND SEEDLING SURVIVAL

Foresters, particularly in southwest Oregon, have long recognized that reforestation is an uncertain process. Recent research completed by Dieter Schöne for his Ph.D. in Forest Management at OSU has yielded insight into the uncertainties of the reforestation process in southwest Oregon. Dieter used a technique called Bayesian analysis to study the effects that site characteristics have on the probability of reforestation success with regard to optimum planting densities and the return on investment of gathering additional site information. He conducted the study at two ecologically and politically different areas; the Tillamook region in northwest Oregon and the south Umpqua area in southwest Oregon.

The results of this study are intriguing. Despite different ecologic conditions and management goals, the reductions in reforestation costs that could be achieved and the amount of money that could be spent per acre to acquire site information to increase reforestation success are very similar for the two areas. The reasons, however, differ.

For southwest Oregon, the central implication is that regeneration foresters must be keenly aware of specific site characteristics because of the region's greater ecologic diversity. But, which site characteristics appear to be important predictors of reforestation success?

For the southwest Oregon data base, soil water availability, dry season precipitation, aspect and competing vegetation were among the more important site characteristics that were related to seedling survival. Associated with this, the cumulative distribution of first year survival is related to site productivity. More productive sites have greater probabilities for high rates of survival, although sites with low productivity can also show very good survival.

Other significant findings include a strong (r = .89) regression equation that estimates total trees per acre from "effective" trees per acre measured from stocking surveys; and the development of a relation between soil water availability and soil texture which is presented as a series of isolines on the textural triangle.

This research is an important benchmark in reforestation operations. In addition to further identifying and clarifying relations between site characteristics and reforestation success, this study shows how to use knowledge of site characteristics most effectively in establishing optimum levels of stocking on a site specific basis. For more information contact: Dr. Dieter Schone, Am Unkersberg 1, 555 Ardel, West Germany, or Dr. John Beuter, Department of Forest Management, Oregon State University, Corvallis, OR 97331.

O. H.

## ADDITIONAL THOUGHTS ON MULTIPLE STUMP CABLE ANCHORS

An article in the Summer, 1982 issue of the FIR REPORT discussed some recent research results regarding multiple stump anchors for cable logging systems. This research, conducted by Gail Kimbell for her Master's degree at OSU's Forest Engineering Department, is valuable work in that it increases our knowledge about the mechanics of multiple stumps rigged in a series for cable system anchors. Results showed that, for the stumps used during the project, only 10 percent of the loaded line tension was being transferred to the second stump instead of the 30 percent that had been assumed previously. Recent discussions with other logging engineers has led to some additional thoughts on this type of anchoring system which should be considered by harvesting project planners and loggers.

If the primary stump in a multiple stump series is strong enough to withstand an applied force, there will be no perceptible forward motion of that stump. As a result, only a small part of the load will be transferred to the second stump. This is the situation that was observed and described in the Kimbell project and in the previous FIR REPORT article. However, if the first stump of a series does move, a different pattern of force distribution is likely.

The series multiple stump anchor system is rigged under the assumption that single stumps are too small and/or weak to withstand the anticipated line tensions. With multiple stump anchors, when the front stump begins to move, the tension in the line between the first and second stumps will increase. Since the line between stumps is already under some tension from rigging, very little movement of the front stump is necessary to transfer a significant part of the load to the second and perhaps subsequent stumps. The load will then be more evenly distributed between stumps. The second stump can thus help to stabilize the front stump and keep it from working loose during the yarding operation. Unfortunately, current knowledge is inadequate to predict how much force is transferred to subsequent stumps when the first one moves.

As was mentioned in the previous FIR article on this topic, an alternate system to distribute loads between two stumps is to use an equalizing block on the end of the tensioned line. This can be a good option when adequate planning time is available because this anchoring system requires additional analysis, equipment and set-up time.

For large yarding equipment and the associated large line sizes, a block large enough to safely transmit cable loads may weigh several hundred pounds. Also, if this type multiple stump anchor is rigged improperly, it can actually apply more force to the individual stumps than if the line were attached directly to either of the stumps. Consider the diagram in Figure 1.

The static equilibrium formula for this system is:

$$\Sigma F_x = 0 = T_g - 2T_e \cos\theta \qquad (1)$$

Therefore,

$$T_e = \frac{T_g}{2\cos\theta} \qquad (2)$$

As the angle $\theta$ approaches 60°, the cosine function approaches 0.5 and the divisor in equation (2) becomes 1.0 making $T_e$, the tension in the equalizing line, the same as the tension in the primary line be it guyline or skyline. If the angle $\theta$ is greater than 60°, the tension in the equalizing line is greater than the tension in the primary line, as is shown for various values of angle $\theta$ and [illegible] in Table 1.

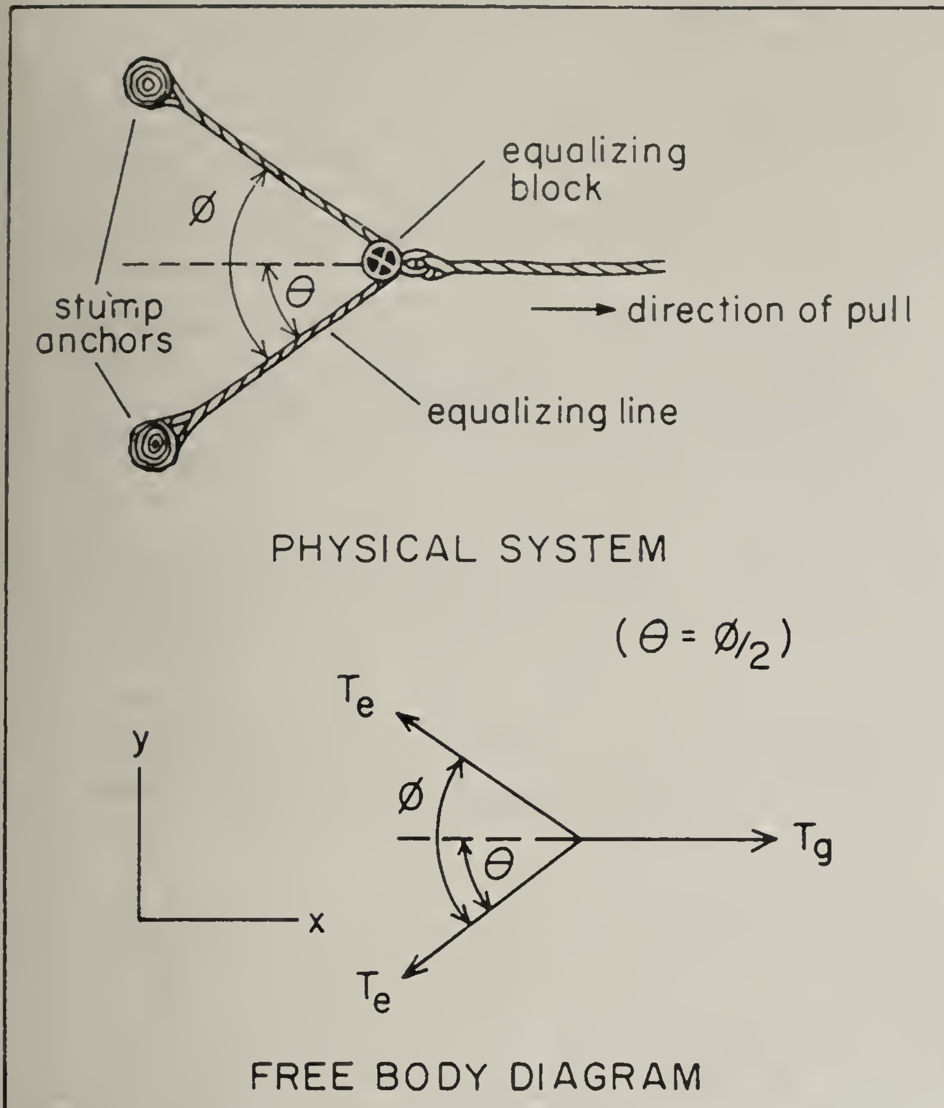


Figure 1. Equalizer block anchoring system.

Table 1. Tensions in equalizing line for various values of the central angle of a two stump anchor.

| $\phi$ | $\Theta$ | $\cos\Theta$ | $T_e$ |
|---|---|---|---|
| 20° | 10° | 0.9848 | 0.5 x $T_g$ |
| 114° | 57° | 0.5446 | 0.92 x $T_g$ |
| 116° | 58° | 0.5299 | 0.94 x $T_g$ |
| 118° | 59° | 0.5150 | 0.97 x $T_g$ |
| 120° | 60° | 0.5000 | 1.00 x $T_g$ |
| 122° | 61° | 0.4848 | 1.03 x $T_g$ |
| 124° | 62° | 0.4695 | 1.07 x $T_g$ |
| 126° | 63° | 0.4540 | 1.10 x $T_g$ |

To gain any advantage from using this type anchoring system, the central angle must be quite small. The force in the primary line is split approximately equally only for central angle ($\phi$) values below 20°. Depending on the distance that the two stumps are apart, this could make for an extremely long equalizing line.

Multiple stump anchors are useful alternatives when single stumps appear too small to oppose the forces generated in cables during logging operations. The series multiple stump anchor configuration is a quick and easy, self-tensioning, tie-back system, but with yet indeterminate transfer of force should the first stump move. Until the front stump moves, the ratio of primary loaded line tension to tie-back line tension is quite high. Series multiple stump anchors can be used effectively but the stumps should be inspected regularly and often during logging to insure the safety of the operation.

The equalizer block multiple stump anchor costs more to rig, but has distributions of tension that are relatively simple to predict. Regular inspection of the stumps also applies to this anchoring method. Both systems have advantages and disadvantages, and both are viable anchoring alternatives that should continue to be a part of the logger's bag of tricks when the strength of a single stump is in doubt. A good understanding of the strength and weaknesses of each method is needed before choosing the one that best fits any particular situation.

John W. Mann, Adaptive FIR
Brian L. Tuor, Forest Engineering, OSU

## PRECOMMERCIAL THINNING OF CLUMPY ADVANCE REGENERATION: DOES IT PAY?

There has been considerable discussion recently on the topic of managing natural regeneration present in stands prior to final harvest. This regeneration may be of preharvest or postharvest origin resulting from the opening up of a stand by partial cutting. In either case, a decision to manage that regeneration for the next rotation means additional harvesting costs to protect reproduction during overstory removal. Even if trees survive logging, no local data documents the growth potential of those trees after overstory removal, although evidence from other studies in the West suggests good growth rates are possible.

The distribution of advance regeneration is frequently clumpy, with the density of trees within groups often substantially greater than optimum for good diameter growth. The economic feasibility of precommercially thinning the clumps to a more reasonable within-clump density is often questioned.

A master's thesis addressing this topic has been completed by Hugh Speechley at U.C. Berkeley, under the direction of John Helms. His thesis, entitled "Projections of growth and economic returns after precommercially thinning young growth California white fir" addresses the issue for stands from the McCloud area in northern California. Selective harvesting of old-growth mixed-conifer stands in the northern Sierra Nevada has resulted in many areas of uneven-aged young-growth stands, which vary in stocking from dense groups to open, unstocked areas.

The objectives of the study were to develop a method of stand description based on types of groups and the proportion of the stand made up of each group. Average diameter and volume growth models were developed for each group type based on easily measured and manipulated variables. A wide range of precommercial thinning prescriptions was applied to each group type using the models to predict the age and volume per acre when a specific average group diameter is reached, corresponding to an expected merchantable limit. Results from each group type are then combined to generate for the whole stand, the age and volume per

acre when the specific average stand diameter is reached. Then, by applying suitable economic variables, including stumpage prices, thinning costs and alternative rates of return, the economic viability of various thinning strategies can be evaluated.

Field work was conducted on a 20-acre stand of young-growth white fir, average site index 85 feet at 50 years, from which an overstory of ponderosa pine had been removed 12 years previously. Six groups were identified based on the diameter of trees in the group. Small type groups had most trees in or below the 6-inch diameter class, with a maximum diameter of 10 inches. Medium groups had most crop trees in the 6- and 8-inch diameter class with a maximum diameter of 12 inches. Large type groups had most of the trees in the 12-inch and greater diameter class. Open type groups were those in each size category in which the current density was too low to be considered for thinning. Dense type groups were those whose basal area exceeded 200 square feet per acre and would be considered for thinning.

Prescriptions were defined in terms of a target number of residual trees per acre for each group type. Using a generated diameter distribution for each type, prescriptions were simulated by first harvesting the overstory down to a specified minimum merchantable diameter limit. Then the group was precommercially thinned, removing all trees from below to a maximum diameter limit.

Precommercial thinning costs were estimated for prescriptions aimed at leaving 100, 200, and 500 residual trees per acre in each group type (about $50/acre). A price for white fir stumpage of $102 per MBF was used, a 2 percent escalation rate in the real price of stumpage up to year 2030 was assumed and a real alternative rate of return of 7 percent was used.

Inputs into the simulation were then as follows:

a) the proportion of the stand made up of each group type;

b) the prescribed residual trees per acre;

c) the diameter limit for overstory removal;

d) the diameter limit for precommercial thinning;

e) the required final diameter for the projection;

f) the economic variables.

The economic value of greatest interest was the net contribution of precommercial thinning to the stand's present worth.

Fourteen prescriptions were simulated with various combinations of diameter limits for precommercial thinning and overstory removal, and target residual trees per acre. If the stand was grown to a final diameter of 16 inches, the prescription yielding the highest contribution to present net worth, + $368 per acre, was that which set the target within groups stocking to 200 trees per acre, the precommercial thinning limit to 7 inches and the overstory removal limit to 15 inches. If the stand was grown to an average diameter of 20 inches, the prescription giving the highest net contribution to present worth, of + $478 per acre, was that which retained 200 trees per acre, set the precommercial thinning limit to 9 inches and the overstory removal limit to 11 inches. These were the highest values associated with the prescriptions tested; they are not necessarily optimal solutions. Holding the stand to a final average diameter of 20 inches always gave a higher contribution to present net worth than an equivalent prescription for growing stands to 16 inches.

In these simulations, the assumption was made that area was 68 percent stocked by groups. When stocking of groups was increased to 80 percent, with more groups of the dense type, the prescription yielding the greatest value for the study area increased in present net worth from $478 to $912 per acre.

Sensitivity to precommercial thinning costs and the base price of stumpage was relatively low. A 20 percent change in thinning cost changed the contribution to present net worth by only ± $9 per acre. Twenty percent changes in the stumpage price caused changes which depended on rotation length. If the stand was grown to 16 inches, the change was only ± $18 per acre, but for a rotation grown to an average diameter of 20 inches, the change was in the order of ± $100 per acre.

The model must be viewed cautiously. It is based on a limited sample and statistically only a moderately good fit to the data. However, if one looks at the differences between costs and contributions to present net worth, break even costs for precommercial thinning are $412 and $522 per acre for final average diameters of 16 and 20 inches, respectively. Based on the current thinning costs and uncertainties in this model, it still appears that precommercial thinning of clumps of white fir to 200 trees per acre after overstory removal can be justified economically.

S. T.

## PRECIPITATION INTENSITY IN THE WESTERN SISKIYOU MOUNTAINS

The recently completed average annual precipitation map for southwest Oregon indicates that precipitation in the Western Siskiyou Mountains has been underestimated by as much as 30 percent in some locations. Do errors also exist in maps depicting precipitation intensity-frequency relationships?

These relationships are valuable for designing forest roads and choosing among forest practices which may expose mineral soil to erosion. Only recently have data been collected at higher elevations to allow a preliminary evaluation of this question. Data must be collected for many years before the results are conclusive, but existing data suggest that precipitation intensity is higher in the Western Siskiyou Mountains than existing isopluvial maps indicate.

The largest 24 hour precipitation event occurring for each month over 20 years (1962-81) was calculated for weather stations near Kerby and Brookings. The 20 largest storms, regardless of the year of occurrence, were selected to construct a partial duration series (PDS) of precipitation intensity and return period. The site specific PDS for Kerby and Brookings give lower precipitation intensity values for a specific return period than do the isopluvial maps for Oregon in the most recent NOAA Atlas (Figure 1).

While the NOAA Atlas overestimates precipitation at these and other low elevation, coastal and interior valley sites, the maximum precipitation intensity projected for the western Siskiyou Mountains appears to be underestimated at higher elevations. This interpretation is based on determining the return periods (calculated from the Kerby and Brookings data) for two recent winter storms measured at four low elevation sites around the western Siskiyou Mountains. These return periods were compared with those predicted from the NOAA Atlas for precipitation from the same two storms measured at two recently installed mountain stations. One site is on the west edge of the Kalmiopsis Wilderness (T28S, R11W, S30; 3,033 ft.) and the other is located in Hunter Creek (T37S, R13W, S9; 2,400 ft.), approximately 15 miles to the northwest. Data from the two sites were provided by Bruce Sims and Russell Gripp of the Siskiyou National Forest.

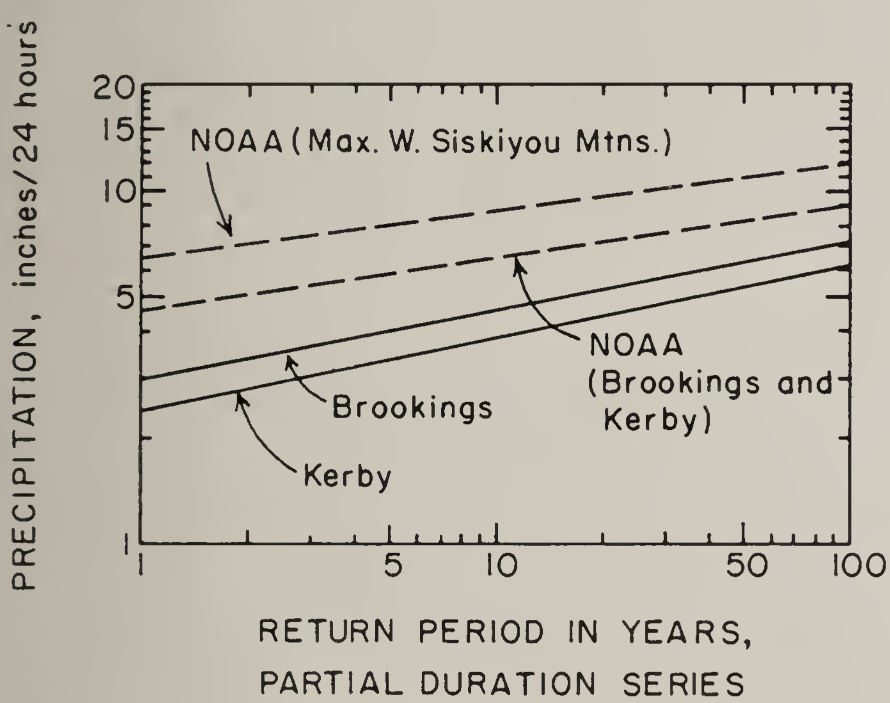


Figure 1. Precipitation intensity versus return period.

Both high elevation sites received between 14.0 and 14.6 inches of precipitation in 24 hours on December 5-6, 1981, and 9.5 and 9.6 inches in 24 hours on February 17-18, 1983. The NOAA Atlas predicts a minimum return period of 30 years for a 10 inch storm, and a return period of over 100 years for a 14 inch in 24 hours storm. Yet for the same storms, Brookings, Gold Beach, Cave Junction and Illahe received five inches or less of precipitation in 24 hours, reflecting return periods of between 2 and 15 years. The strong differences between predicted and actual return periods at the low elevation and mountain stations are the basis for judging the NOAA isopluvial maps as underestimating the precipitation intensity at the higher elevations of the western Siskiyou Mountains.

Users of precipitation data should note that the NOAA isopluvial maps conservatively estimate return periods for maximum 24 hour precipitation events at low elevations in southwest Oregon, i.e., for a given storm intensity the return period is longer than the map shows, or conversely, for a specific return period, the precipitation intensity is less than the maps indicate. As elevation increases, however, the relationship between actual and NOAA data rapidly reverses. A given intensity of precipitation will occur more often than the NOAA data indicates. Based on these limited data, for sites along the coastal side of the western Siskiyou Mountains and above 2,500 ft. elevation, 24 hour precipitation intensities for a given return period should be doubled to better estimate precipitation intensity. Adjustments for sites further east probably need not be as large.

D. M.

# Recent Publications

For copies of these publications, mail your request to the indicated address:

(1) Weed Science Society of America
309 West Clark Street
Champaign, IL 61820

(2) Forest Research Laboratory
Oregon State University
Corvallis, OR 97331

(3) Publications
Intermountain Forest and Range Experiment Station
507 25th Street
Ogden, UT 84401

(4) Publications
Pacific Northwest Forest and Range Experiment Station
P.O. Box 3141
Portland, OR 97208

HERBICIDE HANDBOOK OF THE WEED SCIENCE SOCIETY OF AMERICA, FIFTH EDITION, by WSSA Herbicide Handbook Committee. 1983. This fifth edition of the Herbicide Handbook describes herbicides, desiccants, plant growth regulators, names of various adjuvents, protectants, abbreviations, definitions and conversion factors used in weed science. Information on all compounds has been reviewed and revised. All herbicides are listed alphabetically by their common names or by code designations for unnamed compounds. Indices for common and trade names, and chemical names are also included. As with past editions, information on each herbicide covers chemical properties, herbicidal use, use precautions, physiological and biochemical behavior, behavior in or on soils, toxicologic properties, and sources of further information. The book is not a summary of current federally registered herbicide uses, but is written for those wanting additional information on herbicide properties that are not typically included on product labels.

(1)

THE EFFECT OF BRUSH COMPETITION AND PLASTIC MULCH ON MOISTURE STRESS ON PLANTED DOUGLAS-FIR, by J. R. Tonn and R. T. Graham. 1982. USDA Forest Service, Res. Note 320, Intermountain Forest and Range Experiment Station, Ogden, UT. 4 p. The effects of black plastic mulch and brush competition on seedling plant moisture stress,

soil temperature and survival of planted 2-0 Douglas-fir seedlings in northern Idaho were investigated. Seedlings were planted in 12-year-old brush 2 to 8 feet tall, in 3 by 3 foot cleared blocks, and similarly sized natural openings. No significant differences for mean plant moisture stress, soil temperature or survival were observed between treatments at the end of the first summer. Survival ranged between 83 and 90 percent. Mean plant moisture stress was significantly greater 30 days after planting (May) than any other date during the summer. Precipitation averaged 1.85 inches per month from May through October. July and August received at least 1.5 inches of precipitation each month. Thus treatment effects were not fully tested with regard to soil moisture drawdown. Also, the small treatment areas relative to the size of the brush could have been ineffective at creating treatment differences because roots from adjoining brush may have occupied the opened areas.

3

ENERGY EXCHANGE OF TRANSPLANTED DOUGLAS-FIR SEEDLINGS ON TWO CUTOVER SITES IN SOUTHWEST OREGON, by J. A. Vanderwall. 1983. 16th Conference on Agriculture and Forest Meteorology, Ft. Collins, Colorado, p. 214-215. An energy balance was prepared for 2-0 bareroot, Douglas-fir seedlings planted in clearcut and shelterwood harvested units approximately two miles north of the Oregon Caves National Monument. A portion of seedlings in each unit was also shaded by shadecards. In the clearcut, shadecards decreased the solar radiation a seedling received by 22 percent. The combination of shelterwood and shadecards reduced solar radiation by 47 percent, and the shelterwood alone reduced incoming solar radiation by 29 percent compared to the open clearcut. Water use per unit leaf area by seedlings in the clearcut was high early in the season but decreased markedly by July and August. Under the partial cut, initial water use was about one-third of the rate in the clearcut, increased about 50 percent, and returned to near starting levels.

2

ACCEPTANCE BY BLACK-TAILED DEER OF FOLIAGE TREATED WITH HERBICIDES, by Dan L. Campbell, James Evans, Gerald D. Lindsey, and William E. Dusenberry. Res. Pap. PNW-290. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Forest and Range Experiment Station, Olympia, WA: U.S. Department of the Interior, Fish and Wildlife Service, Forest-Animal Damage Control Research Project. 1981. 31 p. To test their acceptance of foliage treated with herbicides, captive black-tailed deer were exposed to Douglas-fir seedlings and salal treated with standard formulations of 2,4,5-T, 2,4-D, atrazine, dalapon, fosamine, and glyphosate herbicides. Carriers were diesel oil and water. Tests were made from November 1977 through February 1978. Deer readily browsed 2,4,5-T treatments and most formulations of 2,4-D in oil compared with oil alone, but rejected some phytotoxic glyphosate treatments. Consumption of herbicide-treated foliage did not cause noticeable health problems in test animals.

4

RESEARCH ON FOREST AND RANGE SOILS IN OREGON AND WASHINGTON: A BIBLIOGRAPHY WITH ABSTRACTS FROM 1975 THROUGH 1979, by G. O. Klock and R. F. Tarrant. 1981. USDA Forest Service, Gen. Tech. Rep. PNW-30. Pacific Northwest Forest and Range Experiment Station, Portland, OR. 23 p. An annotated bibliography of 218 papers and theses on forest and range soils in Oregon and Washington supplementing three earlier bibliographies published by the Pacific Northwest Forest and Range Experiment Station.

4



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